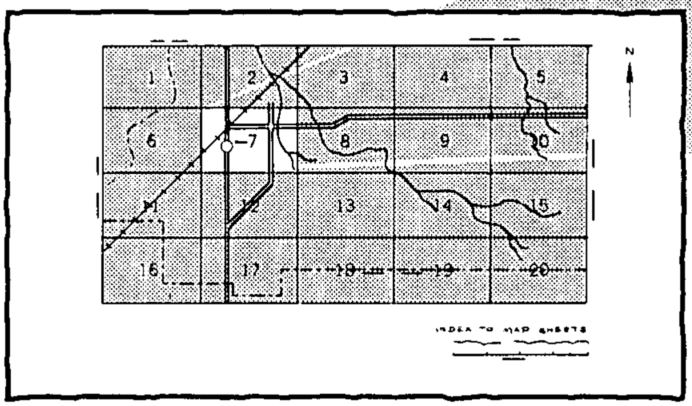
SOIL SURVEY OF

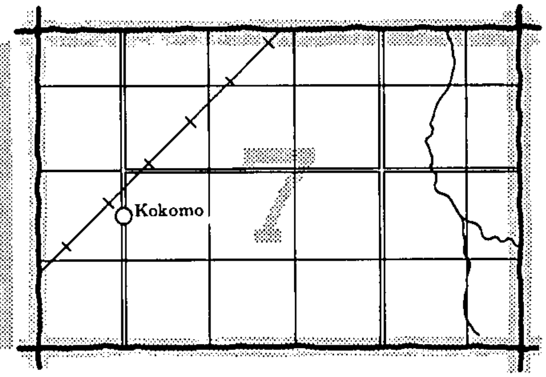
WASHITA COUNTY, OKLAHOMA

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Oklahoma Agricultural Experiment Station

HOW TO USE

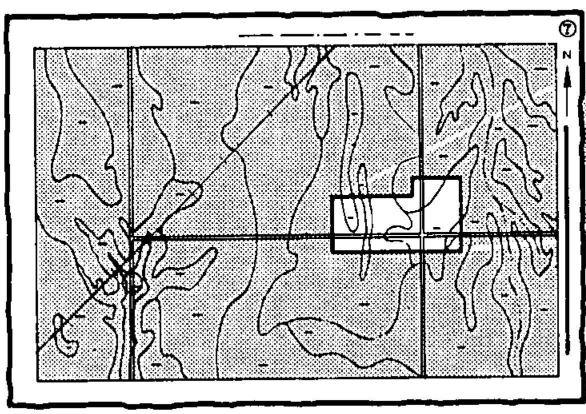
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

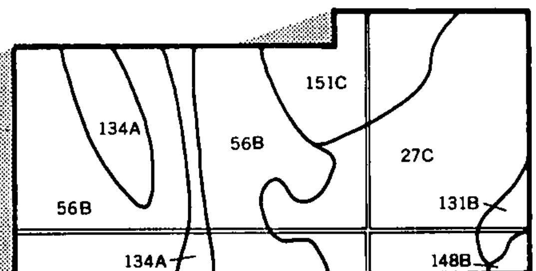




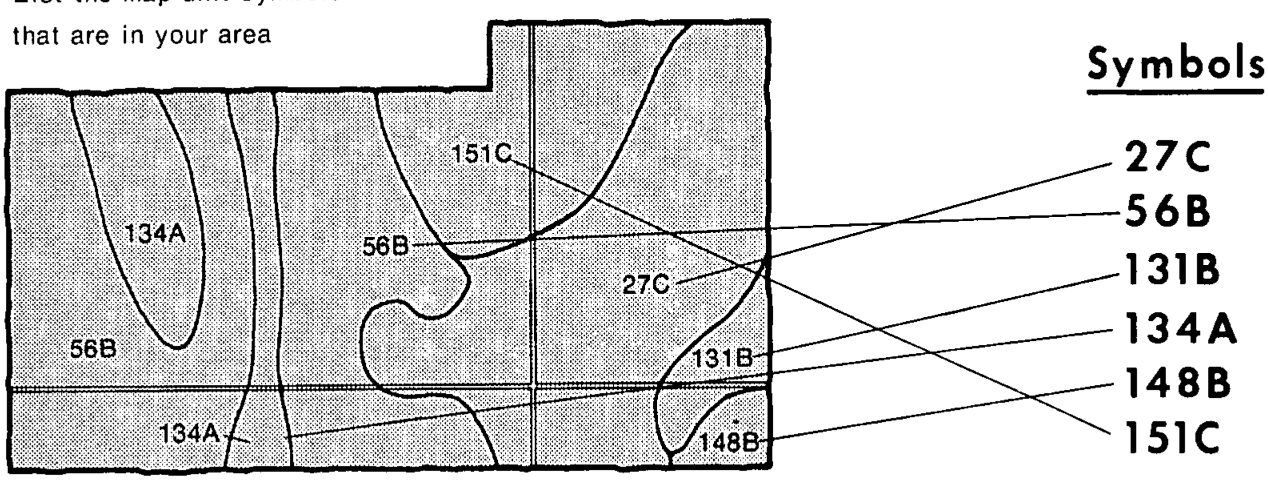
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



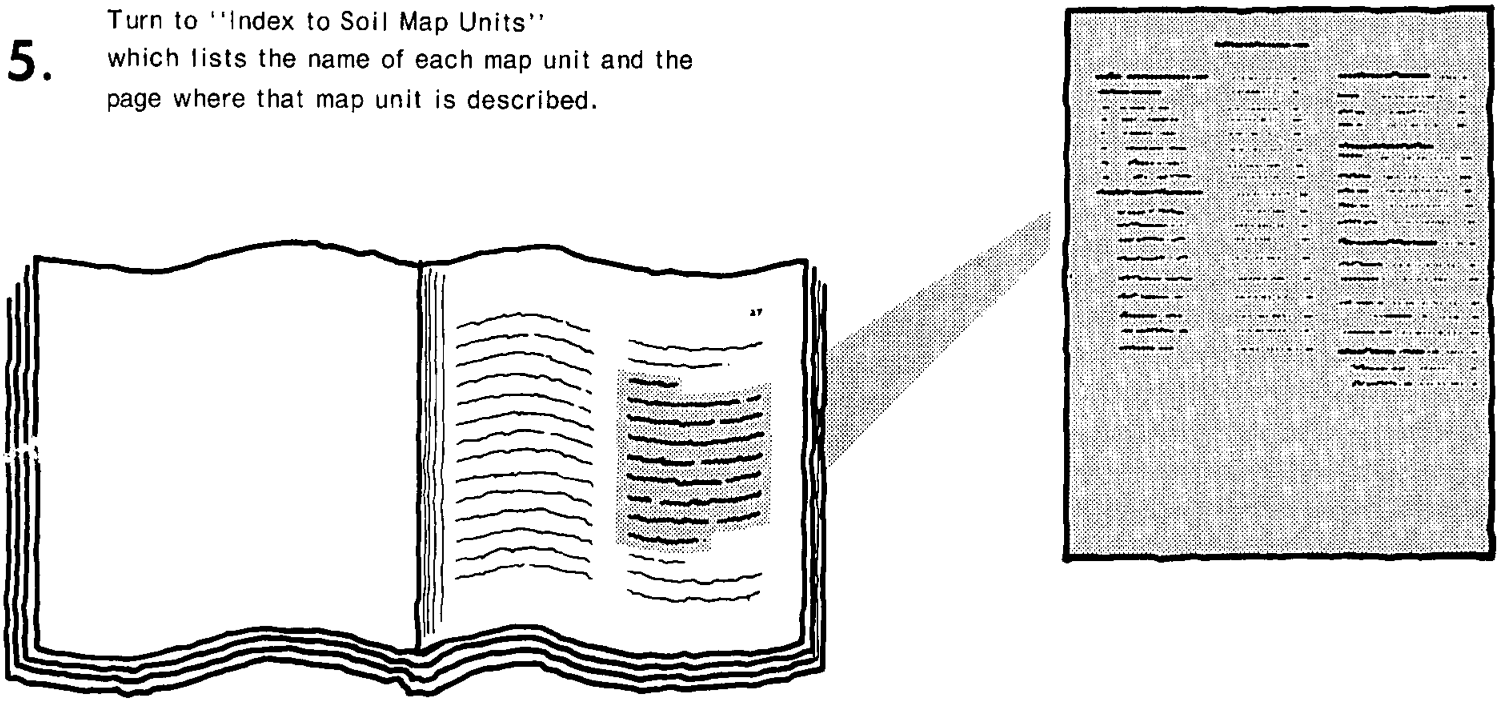


4. List the map unit symbols that are in your area

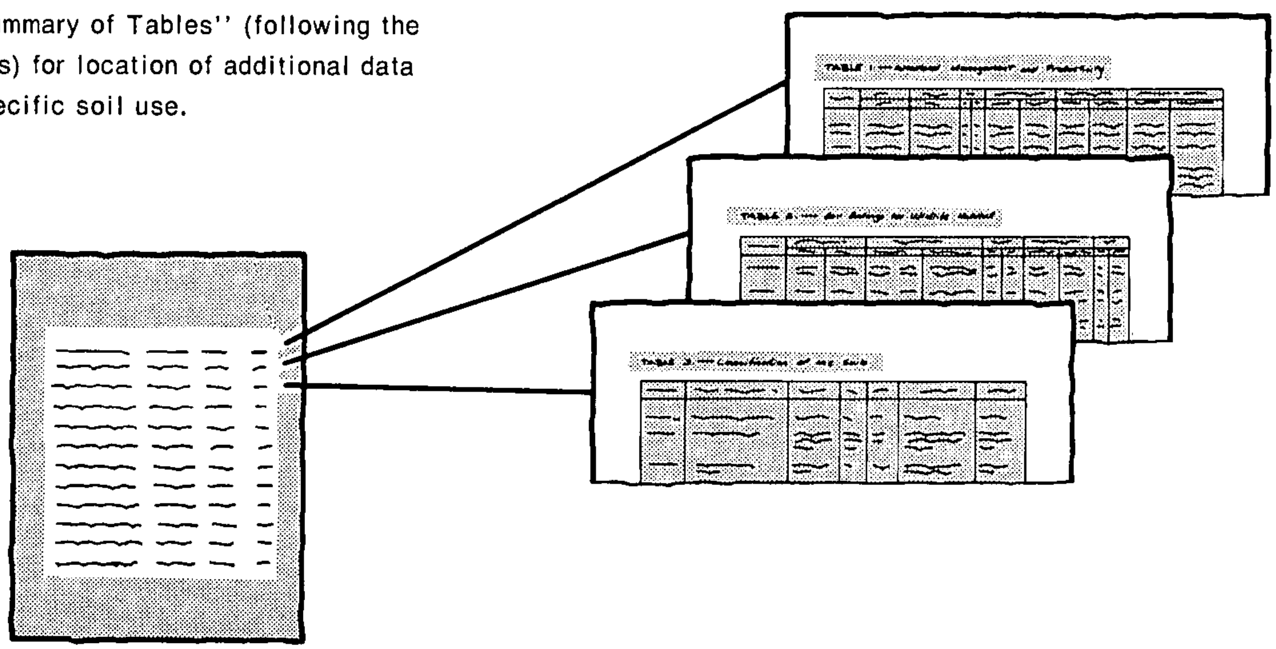


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1961-75. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the conservation districts of Washita County.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Wheat combine on the backslope of a terrace in an area of Grandfield fine sandy loam, 1 to 3 percent slopes.

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Issued May 1979

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Foreword

This soil survey contains much information useful in land-planning programs in Washita County. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

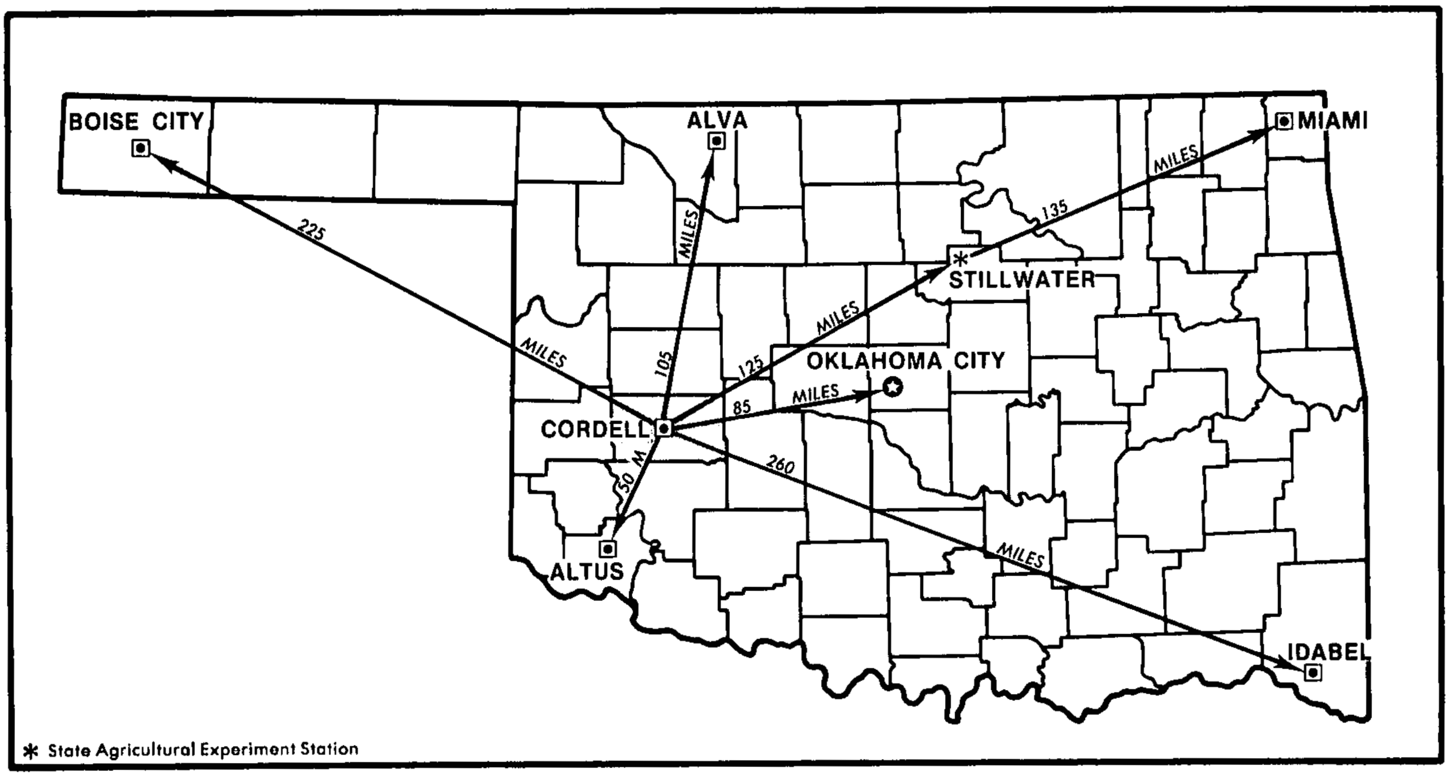
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Roland R. Willis

Roland R. Willis
State Conservationist
Soil Conservation Service



Location of Washita County in Oklahoma.

SOIL SURVEY OF WASHITA COUNTY, OKLAHOMA

By Hamilton H. Moffatt and Arlin J. Conradi, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with Oklahoma Agricultural Experiment Station

WASHITA COUNTY is in the west-central part of Oklahoma. According to the 1970 census by the U. S. Department of Commerce, the county had a population of 12,141. Cordell, the county seat, had a population of 3,261. The total area of the county is 646,400 acres, or 1,010 square miles.

Washita County is in the Central Rolling Red Plains physiographic area. The Washita River and its tributaries drain most of the county. The Washita River flows in a northwest-southeast direction and crosses the eastern one-third of the county. Elk Creek and its tributaries drain the southwestern part of the county. Elk Creek flows in a north-south direction and enters Kiowa County near the town of Sentinel. The topography ranges from nearly level flood plains to smooth, sloping uplands, and there are steep escarpments in a few areas. The slope generally is to the southeast, and the elevation is 1,560 feet above sea level at Cordell.

General nature of the county

This section gives general information about the settlement, natural resources, industry, transportation, recreation and education facilities, agriculture, and climate of Washita County.

Settlement

At one time, Plains Indians hunted roving herds of buffalo in what is now Washita County. This area was included in the Louisiana Purchase in 1803. In the middle and late 1800's, cattlemen driving herds from Texas to markets in Kansas found excellent grazing land here.

In 1882, John Seger founded the town of Colony on the banks of Cobb Creek. Colony was the earliest settlement in the county. Many claims for land were staked by wheat and corn farmers from Kansas in 1892, when the lands were opened to settlement.

In 1900, Washita County was organized, and the town of Cloud Chief became the county seat. Cordell was founded in 1897 as a stop along the route of the Frisco Railroad. In 1904, the county seat was moved to Cordell as a result of an election brought about through a special act of Congress.

From 1898 to 1905, new towns were established along the railroad lines. Among these were Dill City, Foss, and Bessie. The towns of Sentinel and Canute were established in 1899.

Natural resources

Soil is one of the most important natural resources in the county. Agricultural products such as crops and livestock provide the major source of income for the county.

The water supply generally is adequate for livestock, recreation, and domestic uses. Irrigation water is available in some parts of the county. The main sources of water are the Washita River, Elk Creek, Cobb Creek, and the underground Rush Springs Sandstone Formation in the eastern part of the county.

On flood plains, the irrigation wells generally are less than 100 feet deep. Irrigation wells in alluvial deposits of sand and gravel can produce up to 800 gallons of water per minute. Some irrigation water is pumped directly from streams. Irrigation wells in the Rush Springs Sandstone Formation generally are 150 to 400 feet deep and produce 150 to 600 gallons per minute. Flood control structures and farm ponds also produce some water for irrigation. The quality and quantity of surface water generally is not so dependable as that of water obtained from wells. Surface water can be high in content of dissolved gypsum, and in summer evaporation rates are high.

The exploration and development of oil and natural gas are prevalent in some areas. Gypsum is a prominent natural resource in the eastern part of the county. The gypsum beds range in thickness from 118 feet in the Cloud Chief Formation to 1 foot in outlying areas.

Gypsum is used mainly for agricultural purposes. A surface mining operation is located about 17 miles east of Cordell.

Clay is prevalent in many areas but has not been developed commercially. Deposits of volcanic ash are located in the south-central part of the county. This ash can be used as a component in the manufacturing of lightweight concrete or abrasives, but it needs to be purified.

Red shale outcrops in many areas, mainly in the northwestern part of the county. The shale belongs to the Doxey Member of the Quartermaster Formation. It is used mainly in road surfacing.

Industry

Agriculture is the major industry in Washita County. Other industries include manufacturers of bedspreads and draperies, fishing supplies, and leather goods.

Transportation

The major highways in Washita County include U.S. Highways 183 and 66; State Highway 152, running east and west; State Highways 54 and 44, running north and south; and Interstate 40, which parallels the northern border of the county. Railroad service is available in some areas. There are airports at Cordell and Burns Flat.

Recreation

Recreation activities in Washita County include swimming, fishing, hunting, camping, and hiking. There are recreation facilities for tennis, baseball, bowling, and golf. Theaters, municipal parks, playgrounds, and rodeo grounds also are located in the county.

Education

The Washita County Public School System is made up of six independent districts, which include six high schools, six junior high schools, and nine elementary schools. One private school, the Corn Bible Academy, is located at Corn. The Western Oklahoma Area Vocational-Technical School is located at the Clinton-Sherman Industrial Air Park.

Agriculture

Washita County is mainly agricultural. About 70 percent of the acreage is used for cultivated crops. About 207,000 acres is in wheat, 76,400 acres in cotton, 38,300 acres in sorghum, 19,000 acres in alfalfa, 13,600 acres in oats, and 11,100 acres in rye. Other crops grown in the county, on a smaller scale, are barley, peanuts, soybeans, corn, and guar. Beef cattle, dairy operations, hogs, poultry, and sheep are other major sources of agricultural income. In 1973 there were 98,000 cattle and calves in the county.

Markets for small grain and feed are available. There are 10 elevators in the county that store most of these crops. On-farm storage is available on about 1,000 farms. Ten cotton gins serve the cotton industry.

Native rangeland makes up about 25 percent of the acreage of the county. Terminal markets for the livestock industry are in Oklahoma City and in Fort Worth and Amarillo, Texas. Community auction sales provide an active local livestock market.

Climate

In Washita County, winters are alternately mild and very cool. Cold fronts repeatedly cause sharp drops in temperature, but the temperature moderates quickly. Summers are hot. Precipitation is light in winter. The annual precipitation generally is adequate for wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Cordell, Oklahoma, for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 40 degrees F, and the average daily minimum is 28 degrees. The lowest temperature on record, -5 degrees, was recorded at Cordell on January 23, 1966. In summer, the average temperature is 81 degrees, and the average daily maximum is 94 degrees. The highest temperature, 114 degrees, was recorded on June 14, 1953.

Growing degree days, shown in table 1, are equivalent to "heat units." Beginning in spring, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

About 18 inches, or 69 percent of the annual precipitation, falls in the growing season, from April through September. In 2 years out of 10, rainfall in the growing season is less than 14 inches. The most rainfall recorded in a 24-hour period was 4.35 inches at Cordell on August 19, 1961. There are about 51 thunderstorms each year, and 22 of them are in summer.

The average seasonal snowfall is 8 inches. The greatest snow depth on record is 8 inches. On the average, 4 days in winter have at least 1 inch of snow, but the number of days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night in all seasons, and the average humidity at dawn is 80 percent. The percentage of possible sunshine is 75 in summer and 60 in winter. The prevailing winds are from the north-north-

west. The highest average windspeed, 15 miles per hour, is in March.

Duststorms sometimes occur in spring, when strong dry winds blow over unprotected soils. Tornadoes and severe thunderstorms, which are sometimes accompanied by hail, occur occasionally. These storms are local and brief; damage is variable and spotty.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After classifying and naming the soils, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodland, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are described in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior characteristics may be modified during the course of the survey. New interpretations are made for local use, mainly through field observation of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information is then organized so that it is usable to farmers, managers of rangeland and woodland, engineers, planners, developers and builders, and home buyers.

General soil map for broad land use planning

The general soil map at the back of this publication shows map units that have a distinct pattern of soils, relief, and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

Descriptions of map units

1. Grandfield-Dill-Quinlan

Deep to shallow, nearly level to rolling, well drained loamy soils that formed in loamy sediment or in material that weathered from weakly consolidated sandstone; on uplands

This map unit is mainly in the northwestern part of the county in the Dill City, Burns Flat, and Canute areas. This unit makes up about 16 percent of the county. It consists of about 46 percent Grandfield soils, 24 percent Dill soils, 23 percent Quinlan soils, and 7 percent soils of minor extent.

Grandfield soils are deep and are nearly level to gently sloping. Dill soils are moderately deep and are nearly level to rolling. Quinlan soils are shallow and are very gently sloping to rolling. The Grandfield, Dill, and Quinlan soils are on uplands.

The minor soils are the well drained, loamy Clairemont, Port, and Reinach soils, which are on bottom lands along drainageways, and the very gently sloping St. Paul soils on uplands.

The soils in this map unit are used mainly as cropland, but in some areas they are used for pasture or range. The principal crops are cotton, wheat, and grain sorghum. Bermudagrass and weeping lovegrass are the main pasture grasses.

This unit has a high potential for cultivated crops. In some areas, the shallowness of the soils and rock outcrops are limitations. Wind erosion and water erosion are limitations for farming and for residential and other urban uses, but they can be overcome by good conservation planning. The potential of these soils for use as openland wildlife habitat is medium.

2. Cordell-Rock outcrop

Shallow, very gently sloping to moderately steep, somewhat excessively drained loamy soils that formed in material that weathered from hard red siltstone; on uplands

This map unit is mainly in the northwestern part of the county. It makes up about 8 percent of the county and is about 78 percent Cordell soils, 20 percent Rock outcrop, and about 2 percent Grandfield, Dill, and Quinlan soils.

This map unit unit is used mainly for range, but some small areas are used for crops, mainly wheat, which is used for winter grazing. Native vegetation is dominantly short and mid grasses. Overgrazing is the major conservation problem on this unit. If overgrazing is controlled, runoff will be reduced, water intake and plant growth will increase, and a protective ground cover can be established.

This unit has low potential for use as cropland or woodland and for residential and urban development. Shallowness to bedrock is a limitation that is not economically feasible to overcome. This unit has medium potential for recreation uses because of slope and the shallowness to bedrock. It has low potential for the development of habitat for openland wildlife such as quail and rabbits because the soils do not produce an adequate amount of food and cover.

3. Devol-Grandfield-Pratt

Deep, nearly level to strongly sloping, well drained sandy and loamy soils that formed in sandy or loamy eolian or alluvial material; on uplands

Most areas of this map unit are west and south of Dill City. This map unit makes up about 3 percent of the county. It consists of about 50 percent Devol soils, 46 percent Grandfield soils, and 4 percent Pratt soils.

In most areas, Devol and Grandfield soils are at a slightly lower elevation than Pratt soils. Devol and Grandfield soils generally have smoother slopes, have a more loamy subsoil, and have a higher available water capacity and natural fertility than Pratt soils, which are sandy throughout.

The soils in this map unit are used mainly for crops, but in some large tracts they are used for native range and improved pasture. The main crops are cotton, grain sorghum, and wheat. Bermudagrass and weeping lovegrass are the main pasture grasses. On native rangeland, tall and mid grasses are the dominant vegetation. The hazard of wind erosion is the main limitation to the use of these soils for farming and for most other uses.

If they are protected from wind erosion, these soils have medium potential for cultivated crops. They have high potential for most residential and urban uses. They have medium potential for recreation uses because their sandy surface layer cannot withstand intensive foot traffic without deterioration of the ground cover of grass. These soils have medium to high potential for the development of habitat for openland wildlife. Low fertility and the sandy surface layer are the main limitations to growing grain and seed crops for openland wildlife.

4. Shellabarger-Hardeman-Pond Creek

Deep, nearly level to sloping, well drained, loamy soils that formed in loamy material; on uplands

The areas of this map unit are in the eastern part of the county. This unit makes up about 9 percent of the county. It is about 28 percent Shellabarger soils, 22 percent Hardeman soils, 19 percent Pond Creek soils, and the rest is soils of minor extent.

Shellabarger and Pond Creek soils generally are in smooth areas on hilltops and hillsides. They have a firmer, more clayey subsoil than Hardeman soils. Hardeman soils are on foot slopes along drainageways and at the base of small hills on uplands.

The minor soils are the moderately deep to deep Dill, Binger, and Woodward soils and the shallow Quinlan soils. These are loamy, well drained soils on uplands.

This map unit is used mainly for crops, but in some areas it is used for pasture or range. The main cultivated crops are wheat, cotton, and grain sorghum. Bermudagrass and weeping lovegrass are the main pasture grasses. On rangeland, the native vegetation is dominantly mid and tall grasses.

This unit has high potential for cultivated crops, but in sloping areas the soils are subject to erosion. This unit has high potential for most urban and recreation uses and for use as wildlife habitat. The potential is high for trees in windbreaks and post lots.

5. Dougherty-Eufaula

Deep, nearly level to sloping, well drained to somewhat excessively drained sandy soils that formed in thick sandy sediment or eolian material; on uplands

This unit is mainly in the eastern part of the county. It makes up less than 1 percent of the county and is about 2,000 acres in size. This unit is about 30 percent Dougherty soils, 20 percent Eufaula soils, and 50 percent soils of minor extent.

Dougherty and Eufaula soils are on the same landscape. Dougherty soils are more fertile and have a

higher available water capacity than Eufaula soils. They have a loamy subsoil that Eufaula soils do not have.

The minor soils in this unit are the shallow Quinlan soils, the deep Grandfield soils, and the moderately deep Dill soils.

The soils of this unit are used mainly for crops. The main crops are cotton, wheat, and grain sorghum. A small area is used for improved pasture of bermudagrass and weeping lovegrass. A small acreage is still in native vegetation that is dominantly blackjack oak trees and an understory of grass. These soils are sandy and are subject to wind erosion if cultivated and left unprotected in winter and spring, when winds are strongest. Because of this limitation, they have a medium potential for cultivated crops.

These soils have high potential for most urban uses. Because of the rapid percolation of water in the substratum, which can cause contamination of ground water, these soils are limited as sites for sanitary facilities. These soils have medium potential for recreation uses and for use as wildlife habitat. The limitations to these uses are the sandy surface layer, which has low fertility, and the low capacity of these soils for withstanding heavy foot traffic. These limitations can be overcome by increasing the amount of ground cover to stabilize the soil and by increasing the amount of humus in the soil to improve the fertility of the surface layer.

6. Clairemont-Port-Reinach

Deep, nearly level, well drained loamy soils that formed in alkaline loamy alluvium; on flood plains and low terraces

The areas of this unit are along the major streams in the county. This unit makes up about 8 percent of the county. It is about 58 percent Clairemont soils, 20 percent Port soils, 12 percent Reinach soils, and 10 percent soils of minor extent.

Clairemont and Port soils are on bottom lands that are subject to flooding. Reinach soils are on low terraces that are rarely flooded.

The minor soils are the somewhat poorly drained, loamy Retrop soils that have a high water table, the well drained, loamy Yahola soils, and the loamy Amber soils that are rarely flooded.

This unit is used mainly for crops, but some areas are used for tame pasture. The main crops are wheat, cotton, grain sorghum, and alfalfa. Bermudagrass is the main pasture grass. A few areas are in native vegetation that consists of tall grasses and an overstory of hardwood trees such as oak, hackberry, elm, pecan, and cottonwood.

This unit has high potential for cultivated crops and pasture and for use as wildlife habitat. It has low potential for residential and other urban uses because of the flood hazard. The potential is medium to low for recreation uses because of flooding.

7. St. Paul-Carey-Obaro

Deep and moderately deep, nearly level to strongly sloping, well drained loamy soils that formed in calcareous loamy material; on uplands

This map unit forms a broad band across the county from the southwest to the northeast. This unit makes up about 55 percent of the county. It is about 29 percent St. Paul soils, 20 percent Carey soils, 17 percent Obaro soils, and 34 percent soils of minor extent.

St. Paul and Carey soils are on upland flats, hilltops, and hillsides. St. Paul soils have a thicker dark colored surface layer than Carey soils. Obaro soils have a lighter colored surface layer, more lime, and are shallower to bedrock than St. Paul or Carey soils.

The minor soils are the loamy, well drained Woodward soils, the shallow loamy Quinlan soils, the deep loamy Dodson and Abilene soils, the very shallow Cornick soils, the moderately deep Vernon soils, and the loamy Clairemont, Port, and Amber soils.

This unit is used mainly for crops, but many areas are used for pasture and range. The main crops are wheat and cotton. Bermudagrass and weeping lovegrass are the dominant pasture grasses. Tall and mid grasses are the main native grasses.

This unit has high potential for cultivated crops; however, water erosion is a major conservation problem. Erosion can be effectively controlled through good conservation planning. This unit has medium to high potential for most urban and residential uses. St. Paul soils have moderate shrink-swell potential, but this can be overcome by good design and careful installation of foundations. This unit has high potential for recreation uses. It has medium to high potential for the development of habitat for openland wildlife such as quail, doves, rabbits, and red fox. The Obaro soils have a limitation to this use because they do not produce an adequate amount of food and cover.

Broad land use considerations

Deciding which land should be used for urban development is an important issue in the survey area. Each year a considerable amount of land is developed for urban uses in Cordell, Corn, Sentinel, and other cities in the county. It is estimated that about 10,000 acres in the county is urban or built-up land. The general soil map is helpful in planning the general outline of urban areas; it cannot be used for the selection of sites for specific urban structures. In general, the soils in the survey area that have medium potential for cultivated crops also have medium potential for urban development. The data about specific soils in this survey can be helpful in planning future land use patterns.

Areas where the soils are so unfavorable that urban development is prohibitive are not extensive in Washita County. However, large areas of the Clairemont-Port-

Reinach map unit are flood plains where flooding is a severe limitation. In many areas of the Cordell-Rock outcrop map unit the soils are steep and have hard bedrock within a few feet of the surface; urban development is costly in these areas.

In large areas of the county there are soils that can be developed for urban use at lower cost than can the soils named above. Areas of deep, loamy soils in the Grandfield-Dill-Quinlan map unit and areas of the Shellabarger-Hardeman-Pond Creek map unit and the Devol-Grandfield-Pratt map unit are suitable for urban development. These map units are excellent as farmland, and this potential should not be overlooked when broad land uses are considered. The rolling landscape and the good drainage and other properties of the soils in these units are favorable for residential and other nonfarm uses.

In some areas of the Clairemont-Port-Reinach map unit the soils have high potential for farming but medium or low potential for nonfarm uses. The hazard of overflow is a limitation to the nonfarm uses of these soils.

The steeper areas of the Grandfield-Dill-Quinlan and the St. Paul-Carey-Obaro map units have high potential as sites for parks and extensive recreation areas. Hardwood trees growing on the canyon floors enhance the beauty of many areas in these units. Farm ponds, flood control structures, and natural streams in the Grandfield-Dill-Quinlan and the Shellabarger-Hardeman-Pond Creek map units are conducive to nature study. All of these map units provide habitat for many wildlife species.

Soil maps for detailed planning

The map units on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be used to determine the potential of a soil and to manage it for food and fiber production; to plan land use and improve soil resources; and to enhance, protect, and preserve the environment. More information on each map unit, or soil, is given in the section "Use and management of the soils."

A symbol identifying the soil on the detailed soil maps precedes the name of each map unit. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, St. Paul silt loam, 0 to 1 percent slopes, is one of several phases within the St. Paul series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. The Dougherty-Eufaula complex is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Quinlan and Dill soils, 2 to 12 percent slopes, severely eroded, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Many survey areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas that are too small to be shown on the soil map are identified by a special symbol.

The acreage and proportionate extent of each map unit are given in table 4. Information on soil properties and on limitations, capabilities, and potentials for many uses is given for each kind of soil in other tables. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions

1—Abilene silt loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on broad, smooth uplands.

Typically, the surface layer is dark grayish brown silt loam 12 inches thick. The subsoil is dark grayish brown silty clay loam in the upper 5 inches, grayish brown clay in the next 20 inches, and dark gray silty clay loam in the lower 16 inches. The underlying material, at a depth of 53 inches, is gray silty clay loam.

Included in mapping are a few intermingled areas of Cornick and St. Paul soils. These soils make up about 10 to 20 percent of the acreage, but the areas generally are less than 3 acres in size.

This Abilene soil is high in natural fertility. It is alkaline throughout except for the surface layer, which is slightly acid to neutral. Permeability is moderately slow. Runoff is very slow to slow. Internal drainage is slow. Plant roots can easily penetrate the soil material. The root zone is deep.

This soil has high potential for small grains, grain sorghum, and cotton. It has high potential for hay and pasture crops. Good tilth can be maintained by returning crop residue to the soil. Erosion is a moderate hazard if the soil is left bare for extended periods. Minimum tillage and the use of cover crops following row crops help to reduce runoff and control wind erosion.

This soil has severe limitations for trees, but Siberian and Asiatic elm are suitable trees for the tall row in windbreaks, and black locust, hackberry, green ash, Russian mulberry, Austrian pine, ponderosa pine, and eastern redcedar are suitable trees of intermediate height. If trees are grown in windbreaks or post lots, the survival rate generally is low, tree growth is slow, and the life expectancy is short. This soil is suited to shrubs such as desert willow, tamarisk, and low-growing varieties of arborvitae. Bois-d'arc can be grown for use as posts, but growth generally is slow.

This soil has medium potential for most urban uses. The shrink-swell potential and the corrosivity to uncoated steel are limitations that can be overcome by proper design. The moderately slow permeability in the clay subsoil is a limitation to use of the soil as septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption field or by modifying the field.

This soil has high potential for most recreation uses. The moderately slow permeability is a limitation to the development of camp areas and playgrounds.

This soil has high potential for the development of habitat for openland wildlife such as quail, dove, and rabbits. It can produce an adequate amount of food and cover. Capability unit IIc-1; Hardland range site.

2—Altus and Grandfield soils, 0 to 1 percent slopes. This map unit consists of deep, well drained, nearly level soils on uplands. The Altus and Grandfield soils are closely associated but in an irregular pattern. Altus soils are mainly in slightly depressional areas and Grandfield soils are on knolls or in slightly convex areas. Individual areas of these soils are large enough to be mapped separately, but because of their present and predicted use the soils were not separated in mapping. Most mapped areas consist of both Altus and Grandfield soils; a few areas consist only of one or the other soil.

A typical area consists of about 60 percent Altus soils, 35 percent Grandfield soils, and 5 percent Dill soils. The moderately deep to deep Dill soils generally are in convex areas.

Typically, Altus soils have a brown fine sandy loam surface layer about 10 inches thick. In the upper 6 inches, the subsoil is brown fine sandy loam; between depths of 16 and 26 inches, it is brown loam that has a few distinct dark gray mottles; to a depth of 36 inches, it is grayish brown clay loam that has faint gray mottles; between depths of 36 and 44 inches, the subsoil is grayish brown clay loam that has a few faint yellowish and brownish mottles; and in the lowermost part, to a depth of 64 inches, it is light brownish gray sandy clay loam that has a few distinct yellowish brown mottles. The substratum, to a depth of 72 inches, is light brownish gray sandy clay loam that has many distinct strong brown mottles.

Altus soils are high in natural fertility and in organic matter content. Runoff is very slow, and permeability is moderate. The water table is generally below a depth of 8 feet, but in some areas south and west of Dill City, the water table is between depths of 40 and 60 inches in wet years. Water ponds on the surface of the Altus soils in wet seasons. Ponded areas generally are less than 30 acres in size.

Typically, Grandfield soils have a reddish brown fine sandy loam surface layer about 8 inches thick. In the upper 4 inches, the subsoil is reddish brown light sandy clay loam; between depths of 12 and 53 inches, it is yellowish red sandy clay loam. Below this, to a depth of more than 75 inches, the substratum is yellowish red fine sandy loam that has many white soft powdery lime masses and calcium carbonate concretions.

Grandfield soils are medium in organic matter content and in natural fertility. Permeability is moderate, and runoff is very slow. The root zone is deep and the soil material is easily penetrated by plant roots. The water table is below a depth of 10 feet.

The soils in this map unit have high potential for cultivated crops and for hay and pasture. Wind erosion is a moderate hazard if the soils are cultivated because of the fine sandy loam surface layer. Returning crop residue to the soil and the use of minimum tillage help to control wind erosion and to maintain the organic matter content.

These soils have high potential for trees in windbreaks and post lots.

These soils have high potential for most urban and recreation uses.

These soils have high potential for the development of habitat for openland wildlife such as dove, quail, and rabbits. They produce an adequate amount of food and cover. Capability unit IIe-2; Sandy Prairie range site.

3—Altus and Grandfield soils, 1 to 3 percent slopes. This map unit consists of deep, well drained, very gently sloping soils on uplands. The Altus and Grandfield soils are closely associated but in an irregular pattern. Altus soils are mainly in slightly depressional areas, and Grandfield soils are on knolls or in slightly convex areas. Individual areas of these soils are large enough to be mapped separately, but because of their present and predicted use the soils were not separated in mapping. Most mapped areas consist of both Altus and Grandfield soils; a few areas consist only of one or the other soil.

A typical area of this map unit is about 50 percent Altus soils, 40 percent Grandfield soils, and 10 percent Dill soils. The moderately deep Dill soils generally are in convex areas.

Typically, Altus soils have a dark reddish gray fine sandy loam surface layer about 7 inches thick. Brown light sandy clay loam is in the next 12 inches. Below this, to a depth of 46 inches, the subsoil is grayish brown sandy clay loam that has a few distinct reddish brown mottles; to a depth of 62 inches it is light brown sandy clay loam that has a few faint yellowish and grayish mottles. The substratum, to a depth of 75 inches, is reddish yellow fine sandy loam.

Natural fertility and the organic matter content of Altus soils are high. Runoff is very slow, and permeability is moderate. The water table generally is below a depth of 8 feet, but in wet years in some areas south and west of Dill City, the water table is between depths of 40 and 60 inches. Surface ponding is common on the Altus soils in wet seasons. Ponded areas generally are less than 30 acres in size.

Typically, Grandfield soils have a reddish brown fine sandy loam surface layer about 10 inches thick. The upper part of the subsoil is reddish brown light sandy clay about 10 inches thick; the middle part is reddish brown sandy clay loam 15 inches thick; and the lower part, to a depth of 55 inches, is light reddish brown sandy clay loam. The substratum, to a depth of 75 inches, is light reddish brown sandy clay loam.

The organic matter content and natural fertility of Grandfield soils are medium. Permeability is moderate, and runoff is slow. The root zone is deep, and the soil material is easily penetrated by plant roots. The water table is below a depth of 10 feet.

The soils in this map unit have high potential for cultivated crops and for hay and pasture. If these soils are cultivated, wind erosion is a moderate hazard because of the fine sandy loam surface layer. Returning crop residue to the soil and the use of minimum tillage help to control wind erosion and to maintain the organic matter content.

These soils have high potential for trees in windbreaks and post lots.

These soils have high potential for most urban and recreation uses.

These soils have high potential for the development of habitat for openland wildlife such as dove, quail, and rabbits. They produce an adequate amount of food and cover. Capability unit IIIe-2; Sandy Prairie range site.

4—Amber very fine sandy loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping to strongly sloping soil on river escarpments between first and second bottoms. The areas generally are 25 to 100 feet wide and a few hundred feet to more than a mile long.

Typically, the surface layer is reddish brown very fine sandy loam about 8 inches thick. The subsoil is yellowish red very fine sandy loam 28 inches thick. Between 36 and 64 inches is yellowish red very fine sandy loam stratified with thin layers of reddish brown silty clay loam.

Included with this soil in mapping are small areas of Amber soils that have slopes of 8 to 30 percent.

The organic matter content and natural fertility are moderate. Permeability is moderate, and runoff is rapid. The root zone is deep and the soil material is easily penetrated by plant roots.

This soil has low potential for cultivated crops. Slopes and the erosion hazard are limitations. This soil has high potential for hay and pasture. Controlling erosion and maintaining fertility are the main concerns of management. In the less sloping areas, a cropping system that includes small grains or tame pasture under fertilizer and crop residue management can help to control erosion and maintain fertility. In the more sloping areas, this soil is best suited to permanent pasture grasses or trees.

This soil has medium potential for trees in windbreaks and post lots. Slope and the rapid surface runoff are limitations.

This soil has low potential for most urban uses because of slope. This limitation is difficult to overcome because this soil is on an escarpment of the river flood plain. If this soil is leveled to overcome the problem of slope, flooding can occur.

This soil has medium potential for most recreation uses because of slope.

This soil has high potential for the development of habitat for openland wildlife. It produces an adequate amount of food and cover for openland wildlife such as red fox, rabbit, quail, and dove. Capability unit IVe-3; Loamy Bottomland range site.

5—Binger fine sandy loam, 1 to 3 percent slopes. This is a moderately deep, well drained, very gently sloping soil on uplands. Slopes are smooth and convex.

Typically, the surface layer is reddish brown fine sandy loam about 7 inches thick. Below this, to a depth of 24 inches, the soil material is reddish brown sandy clay loam. The next layer, which is 4 inches thick, is red sandy clay loam that has many fragments of red sandstone. Red weakly cemented sandstone is below a depth of 28 inches.

Included in mapping are some small areas of Shellabarger, Quinlan, Woodward, and Dill soils. Also included are a few areas of eroded Binger soils that have a thin surface layer dissected by shallow rills.

Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is slow. Tilth is good. The root zone is moderately deep, and the soil material is easily penetrated by plant roots.

This soil has high potential for small grains, grain sorghum, cotton, and peanuts. It also has high potential for tame pasture and for hay crops. Maintaining fertility and controlling wind and water erosion are the major management problems. A cropping system that includes the use of crop residue, cover crops, stubble mulching, and minimum tillage protects the soils from wind erosion, increases the water intake rate, reduces runoff, and helps to maintain fertility. Crops respond well to fertilizer that is applied in accordance with the results of soil tests.

This soil has medium potential for trees in windbreaks and post lots. The major limitations are depth to sandstone and the low available water capacity.

This soil has high potential for most urban uses. If public sewer systems are used, there are no significant limitations for houses and light industrial buildings without basements. This soil has a limitation for use as septic tank absorption fields because of the depth to sandstone. But this limitation can be overcome by increasing the size of the absorption field or by modifying the field.

This soil has high potential for development of recreation facilities such as picnic areas, camp areas, playgrounds, hunting areas, and golf courses.

This soil has high potential for development of habitat for openland wildlife such as quail, dove, and rabbits. It produces an adequate amount of food and cover. Capability unit IIe-2; Sandy Prairie range site.

6—Binger fine sandy loam, 3 to 5 percent slopes. This is a moderately deep, well drained, gently sloping soil on uplands. Slopes are smooth and convex.

The surface layer is reddish brown fine sandy loam about 7 inches thick. The subsoil ranges from reddish brown sandy clay loam in the upper part to reddish brown fine sandy loam at a depth of 20 inches. Red weakly cemented sandstone is below a depth of 32 inches.

Included in mapping are small areas of Shellabarger, Quinlan, Woodward, and Dill soils. Also included are a few areas of eroded Binger soils that have a thin surface layer dissected by rills.

Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is medium. The root zone is moderately deep.

This soil has medium potential for small grains, grain sorghum, cotton, and peanuts. Yields are good. Medium fertility, the hazard of wind erosion, and the rapid surface runoff are limitations. The use of crop residue, stubble mulch, cover crops, minimum tillage, and terraces can help in obtaining higher yields, in reducing runoff and wind erosion, and in maintaining fertility.

This soil has medium potential for trees in windbreaks and post lots. The main limitations are depth to sandstone and the low available water capacity.

This soil has high potential for most urban uses. Depth to sandstone is a limitation for septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption field or by modifying the field.

This soil has high potential for the development of recreation facilities such as camp areas, picnic areas, playgrounds, golf courses, and hiking paths. It can withstand heavy foot traffic under a variety of weather conditions.

This soil has high potential for the development of habitat for openland wildlife such as quail, rabbits, and doves. It can produce an adequate amount of food and cover. Capability unit IIIe-2; Sandy Prairie range site.

7—Carey silt loam, 1 to 3 percent slopes. This is a deep, well drained, very gently sloping soil on uplands. Slopes are smooth and convex. The areas are 5 to more than 150 acres in size.

Typically, the surface layer is brown silt loam about 10 inches thick. The upper part of the subsoil is dark reddish gray silt loam; the middle part, which is 22 inches thick, is reddish brown clay loam; and the lower part, to a depth of 44 inches, is light reddish brown clay loam. The next layer is light reddish brown loam 10 inches thick. Red silty sandstone is at a depth of 54 inches.

Included in mapping are areas of Woodward silt loam and St. Paul silt loam and areas, which are less than 1 acre in size, of Quinlan soils. In a few areas, the Carey soil has slopes of less than 1 percent and in other areas it has slopes of more than 3 percent.

Natural fertility is high. Permeability is moderate. Runoff is slow. Tilth is good. The soil material is easily penetrated by plant roots. The root zone is deep.

This soil has high potential for crops such as cotton, wheat, grain and forage sorghum, alfalfa, and pasture crops. To maintain fertility and tilth, crop residue should be returned to the soil. Water erosion is a moderate hazard.

This soil has medium potential for trees in windbreaks and post lots. Tree growth is somewhat limited by the medium available water capacity.

This soil has medium potential for most urban uses. Low strength is a limitation to the use of this soil as sites for houses and small commercial buildings. This limitation can be overcome by good design and careful installation.

This soil has high potential for the development of recreation facilities such as campgrounds, picnic areas, playing fields, and golf courses.

This soil has high potential for the development of habitat for openland wildlife such as quail, rabbits, doves, and songbirds. It can produce large amounts of food and cover. Capability unit IIe-1; Loamy Prairie range site.

8—Carey silt loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on uplands. It is generally on smooth, convex hillsides and hilltops.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil, to a depth of 44 inches, is reddish brown clay loam. It is underlain by the red, alkaline silty sandstone parent material.

Included in mapping are a few areas of St. Paul, Obaro, Woodward, and Quinlan soils. Also included are a few areas of eroded Carey soils that have a thin surface layer dissected by rills. The rills are less than 100 feet apart and average 1 foot in depth.

Natural fertility is moderate to high. Permeability is moderate. Runoff is medium. The root zone is deep.

This soil has medium potential for row crops and small grains. High yields can be obtained. Slope is a limitation. This soil has high potential for pasture crops. Controlling water erosion and maintaining or improving soil structure and fertility are the major concerns of management. Growing high-residue crops and returning the residue from these crops to the soil increases water intake, reduces runoff, and helps to maintain the content of organic matter. If a soil-depleting crop such as cotton is grown, a winter cover crop should be grown next to help reduce erosion.

This soil has medium potential for trees in windbreaks and post lots. Runoff, slope, and the medium available water capacity limit tree growth; however, some tree species can attain fair growth on this soil.

This soil has medium potential for most urban uses. Low strength is the main limitation, but it can be overcome by adding sandy material to the soil to increase strength. There are no significant limitations to the use of this soil for septic tank absorption fields.

This soil has high potential for most recreation uses; however, slope is a limitation for playgrounds. This limitation can be overcome by leveling and smoothing.

This soil has high potential for the development of habitat for openland wildlife. It produces an adequate amount of food and cover for openland wildlife such as quail, doves, and rabbits. Capability unit IIIe-1; Loamy Prairie range site.

9—Clairemont silt loam, occasionally flooded. This is a deep, well drained, nearly level soil on bottom lands that are flooded occasionally.

Typically, the surface layer is reddish brown calcareous silt loam about 9 inches thick. Between depths of 9 and 44 inches, the soil material is reddish brown calcareous silt loam that has a few thin lenses of loam and fine sandy loam. Below this, to a depth below 62 inches, it is reddish brown calcareous loam that has a few thin strata of fine sandy loam.

Included in mapping are a few areas of Port silt loam and Yahola fine sandy loam.

Natural fertility is high. Permeability is moderate. The root zone is deep.

This soil has high potential for crops such as cotton, alfalfa, wheat, and grain sorghum and for use as tame pasture. Maintaining soil structure and fertility and controlling floods are the main concerns of management. Flooding has been reduced in areas of this soil by establishing upstream watershed protection projects and by building farm ponds. The use of minimum tillage, cover crops, and stubble mulch helps to maintain soil structure and fertility and to increase the water intake rate.

This soil has high potential for trees in windbreaks and post lots.

This soil has low potential for urban uses. The hazard of flooding is the major limitation. Flood control measures have been applied to upstream watersheds; however, high frequency and high intensity rains can still cause some flooding.

This soil has low potential for most recreation uses because of flooding. It has high potential for the development of habitat for openland wildlife in areas that are protected by upstream flood control structures. This soil can produce an excellent quality and quantity of food and cover for openland wildlife such as rabbits, doves, and quail. Capability unit IIw-1; Loamy Bottomland range site.

10—Clairemont silt loam, frequently flooded. This is a deep, well drained soil in entrenched channels of meandering streams. The channels range from 100 to 500 feet in width but are dominantly 100 to 300 feet. They are 8 to about 25 feet deep. The streambanks are 3 to 15 feet high and are vertical in places. Slopes are mainly 5 to 30 percent. In many places, narrow horizontal benches occur in a series from the top of the escarpment to the stream channel. These benches are less than 15 feet wide, and the slopes are mainly 0 to 3 percent. The recent deposits of sediment and debris indicate that this soil is frequently flooded.

Typically, the surface layer is reddish brown calcareous silt loam about 10 inches thick. Between depths of 10 and 70 inches, the soil material is reddish brown calcareous silt loam stratified with thin lenses of fine sandy loam and silty clay loam.

Natural fertility and the organic matter content are high. Permeability is moderate. The hazard of flooding is severe.

Included in mapping are some areas of Port silt loam and a few areas of Yahola fine sandy loam.

This soil is not suited to cultivated crops or hay. The major limitations are the hazard of frequent flooding and steep slopes. In some of the more gently sloping areas this soil can be used for tame pasture. Most of the acreage is in native grasses and trees.

This soil has high potential for trees in windbreaks or post lots.

This soil has very low potential for urban and recreation uses because of the flood hazard and the slope.

This soil has high potential for the development of habitat for openland wildlife such as rabbits and quail. It can produce an adequate amount of food and cover. Capability unit Vw-2; Loamy Bottomland range site.

11—Cordell silty clay loam, 1 to 5 percent slopes. This is a shallow, somewhat excessively drained, very gently sloping to sloping soil on uplands. Slopes are smooth and convex.

Typically, the surface layer is reddish brown silty clay loam about 6 inches thick. The subsoil is red silty clay loam that is about 10 percent siltstone fragments which are less than 1 inch in diameter. Red, hard siltstone is below a depth of 14 inches.

Included in mapping are a few areas of Quinlan soils and areas of Carey silt loam.

Natural fertility and the organic matter content are medium. The available water capacity is low because this soil is shallow. Permeability is moderately slow, and runoff is medium to rapid.

This soil has low potential for cultivated crops. The main limitations are shallowness, the low available water capacity, and the moderately slow permeability. This soil has medium potential for tame pasture and range. Water erosion is a hazard if cultivated crops are grown. A cropping system that includes the use of minimum tillage, stubble mulch, and cover crops helps to reduce runoff and control erosion.

This soil has low potential for trees in windbreaks or post lots. The main limitations are shallowness to bedrock and the low available water capacity.

This soil has low potential for most urban uses. The main limitations are shallowness to bedrock and the hazard of erosion.

This soil has medium potential for most recreation uses. It has high potential for the development of natural scenic areas and picnic areas.

This soil has low potential for the development of wildlife habitat. It does not produce suitable amounts of food and cover for most species of openland wildlife. Capability unit IVe-1; Red Shale range site.

12—Cordell-Rock outcrop complex, 2 to 15 percent slopes. This complex consists of shallow, well drained, very gently sloping to moderately steep soils and outcrops of siltstone that are in broad areas in canyons and on hillsides and ridgetops on uplands (fig. 1). Cordell soils and Rock outcrop are so intermingled that they could not be separated in mapping at the scale used.

Cordell silty clay loam makes up 40 to 55 percent of each mapped area. Typically, the surface layer is reddish brown silty clay loam about 6 inches thick. The subsoil is red silty clay loam that is 10 percent fragments of red siltstone. Hard, red siltstone is at a depth of 14 inches.

Natural fertility and the organic matter content are medium. The available water capacity is low because this soil is shallow. Permeability is moderately slow, and runoff is medium to rapid.

Rock outcrop, which is hard, red siltstone, makes up 25 to 35 percent of each mapped area. Runoff is rapid.

Included in mapping and making up 15 to 20 percent of each mapped area is a very shallow soil that is similar to this Cordell soil except that it has reddish brown silty clay loam 4 to 10 inches thick over red, hard siltstone. This included soil is low in natural fertility and in available water capacity. Permeability is moderately slow, and runoff is medium to rapid.

This complex has low potential for farming and for urban uses. Shallowness to rock, the low available water capacity, and the moderately slow permeability are limitations that are very difficult to overcome.

This complex has low potential for trees in windbreaks and post lots. Some trees can be grown, but their growth is limited by the low available water capacity and the shallowness to bedrock.

This complex has medium potential for most recreation uses. It has high potential, in the more gently sloping areas, for the development of natural scenic areas and picnic areas.

This complex has low potential for the development of habitat for openland wildlife. It does not produce an adequate amount of food and cover. Capability unit VIe-1; Cordell part in Red Shale range site, Rock outcrop part not assigned to a range site.

13—Cornick-Rock outcrop complex, 1 to 12 percent slopes. This complex consists of very shallow, well drained, very gently sloping to strongly sloping soils and outcrops of gypsum on hilltops and hillsides and in canyons on the uplands. The Cornick soil and Rock outcrop are so intermingled that they could not be separated in mapping at the scale used.

Cornick silt loam makes up 50 to 65 percent of each mapped area. Typically, the surface layer is brown silt loam about 7 inches thick. White gypsum abruptly underlies the surface layer.

Natural fertility is low because this soil is very shallow. The organic matter content in the upper 5 to 10 inches is

high, but this soil is limited in productivity because it is very shallow. The available water capacity is low. Permeability is moderate. Runoff is medium to rapid, depending on slope.

Rock outcrop makes up 25 to 35 percent of each mapped area. It is weathered gypsum, 0 to 5 inches thick, over unaltered gypsum. Runoff is rapid.

Included in mapping and making up 10 to 20 percent of each mapped area is a soil that is similar to this Cornick soil but has 10 to 20 inches of brown silt loam over gypsum. This included soil is medium in natural fertility and is high in organic matter content. Productivity is limited by the shallowness to gypsum and by the low available water capacity. Permeability is moderate, and runoff is slow. Also included are areas of Carey silt loam and St. Paul silt loam.

This complex has low potential for farming and for urban uses. Shallowness to gypsum is a limitation that is difficult to overcome.

This complex has low potential for trees in windbreaks and post lots because of the shallowness to gypsum bedrock and the low available water capacity.

This complex has medium to low potential for most recreation uses. It has high potential for the development of natural scenic areas.

This complex has low potential for the development of habitat for openland wildlife because it does not produce adequate food and cover for wildlife such as quail, rabbits, doves, and songbirds. Capability unit VIs-1; Cornick part in Gyp range site, Rock outcrop part not assigned to a range site.

14—Devol loamy fine sand, 0 to 3 percent slopes (W). This is a deep, well drained, nearly level to very gently sloping soil on uplands. The relief is uneven and consists of low crests separated by valleys.

Typically, the surface layer is reddish brown loamy fine sand about 12 inches thick. The upper part of the subsoil is reddish brown fine sandy loam about 7 inches thick. Below that, to a depth of 36 inches, the subsoil is red fine sandy loam. Next, reddish yellow fine sandy loam extends to a depth of 64 inches. Red, weathered sandstone is below a depth of 64 inches.

Included in mapping are some small areas of Pratt loamy fine sand and Dill fine sandy loam. Also included are a few areas of a soil that is similar to this Devol soil but has sandstone at a depth of 40 to 60 inches and areas of a soil that has a sandy clay loam subsoil that extends to a depth of more than 60 inches. In a few areas in the eastern part of the county the soils have a loamy fine sand surface layer 20 to 40 inches thick and a sandy clay loam subsoil.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid, and runoff is very slow. The root zone is deep.

This soil has medium potential for cultivated crops. The main limitations are the severe hazard of wind erosion, which is due to the sandy texture of this soil, and medium fertility. This soil has high potential for pasture and hay crops. A cropping system that includes crops that produce large amounts of residue that can be retained on the surface and that includes the use of fertilizer, cover crops, and stubble mulch helps to reduce wind erosion and to maintain fertility.

This soil has medium potential for trees in windbreaks and post lots. The main limitations are the sandy texture and medium fertility.

This soil has high potential for most urban uses. It has medium potential for most recreation uses. The main limitation is the sandy texture which can cause this soil and its vegetative cover to deteriorate if the soil is subjected to heavy foot traffic.

This soil has high potential for the development of habitat for openland wildlife such as red fox, rabbits, quail, and songbirds. It can produce excellent cover and food. Capability unit IIIe-3; Deep Sand range site.

15—Devol loamy fine sand, 3 to 8 percent slopes (W). This is a deep, well drained, gently sloping to sloping soil on uplands. This soil is on low crests and in narrow valleys between the crests. The relief is uneven.

Typically, the surface layer is yellowish red loamy fine sand about 15 inches thick. The subsoil, to a depth of 42 inches, is red fine sandy loam. Below this, to a depth of 60 inches, the soil material is red fine sandy loam. Red, weakly cemented sandstone is below a depth of 60 inches.

Included in mapping are some areas of Pratt loamy fine sand and Dill fine sandy loam. Also included are a few areas of a soil that is similar to this Devol soil but has sandstone at a depth between 40 and 60 inches and a soil that has a sandy clay loam subsoil that extends to a depth below 60 inches.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid, and runoff is very slow. The root zone is deep.

This soil has medium potential for cultivated crops. The main limitations are its sandy texture, which results in a high wind erosion hazard, slope, and medium fertility. This soil has high potential for hay and pasture. A cropping system that includes crops that produce a large amount of residue which can be returned to the soil and that includes the use of fertilizer, cover crops, and stubble mulch can protect the soil from wind erosion and maintain fertility.

This soil has medium potential for trees in windbreaks and post lots. The main limitations are its sandy texture and medium fertility.

This soil has high potential for most urban uses. Slope is a limitation for small commercial buildings, but this limitation can easily be overcome by land leveling.

This soil has high potential for the development of habitat for openland wildlife such as quail and rabbits. It

produces adequate cover and fair food crops. Capability unit IVe-5; Deep Sand range site.

16—Devol-Grandfield complex, 0 to 3 percent slopes (W). This complex consists of deep, well drained soils on uplands. The Devol and Grandfield soils are so intermingled that they could not be separated in mapping at the scale used.

Devol loamy fine sand makes up 40 to 55 percent of each mapped area. Typically, the surface layer is reddish brown loamy fine sand about 18 inches thick. The subsoil, to a depth of 50 inches, is reddish brown fine sandy loam. Below this, to a depth of 64 inches, the soil material is reddish brown loamy fine sand.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid, and runoff is very slow. The root zone is deep.

Grandfield loamy fine sand makes up 35 to 45 percent of each mapped area. Typically, the surface layer is reddish brown loamy fine sand about 12 inches thick. In the next 4 inches the soil material is reddish brown fine sandy loam. Below this, to a depth of 32 inches, it is reddish brown sandy clay loam, and next, to a depth of 42 inches, the soil material is yellowish red fine sandy loam. Below that, a layer of yellowish red fine sandy loam extends to a depth of 64 inches.

Natural fertility and the organic matter content are medium. Permeability is moderate, and runoff is very slow. The soil material is easily penetrated by plant roots. The root zone is deep.

Included in mapping are some areas of a soil that has a clayey subsoil which has mottles at a depth of about 20 inches. Also included are a few areas of eroded soils.

This complex has medium potential for cultivated crops. The main limitations are medium fertility and the sandy texture which makes the soils susceptible to wind erosion. This complex has high potential for hay and pasture. A cropping system that utilizes crop residue and uses cover crops, fertilizer, and stubble mulch helps to maintain fertility and control wind erosion.

These soils have medium potential for trees in windbreaks and post lots. The main limitations are medium fertility, the sandy texture, and the medium available water capacity.

These soils have high potential for most urban uses. They have medium potential for most recreation uses. The main limitation is the sandy texture which can cause these soils and their vegetative cover to deteriorate if subjected to heavy foot traffic. This limitation can be overcome by using a sod-type grass cover and by fertilizing intensively to keep the grass vigorous.

These soils have high potential for the development of habitat for openland wildlife such as quail and rabbits. They produce excellent food and cover for wildlife. Capability unit IIIe-3; Deep Sand range site.

17—Devol-Grandfield complex, 3 to 8 percent slopes (W). This complex consists of deep, well drained, gently sloping to sloping soils on uplands. The Devol and Grandfield soils are so intermingled that they could not be separated in mapping at the scale used.

Devol loamy fine sand makes up 50 to 60 percent of each mapped area. Typically, the surface and subsurface layers are reddish brown loamy fine sand about 16 inches thick. The upper part of the subsoil, to a depth of 28 inches, is reddish brown fine sandy loam; the lower part, to a depth of 46 inches, is yellowish red fine sandy loam. Below that, to a depth of 72 inches, the soil material is yellowish red loamy fine sand. Natural fertility and the organic matter content are medium. Permeability is moderately rapid, and runoff is very slow. The root zone is deep.

Grandfield loamy fine sand makes up 20 to 40 percent of each mapped area. Typically, the surface layer is reddish brown loamy fine sand about 12 inches thick. The next layer is reddish brown fine sandy loam about 4 inches thick. Below this, to a depth of 28 inches, the soil material is reddish brown sandy clay loam, and to a depth of 42 inches it is yellowish red fine sandy loam. Below that, a layer of yellowish red fine sandy loam extends to a depth of 62 inches.

Natural fertility and the organic matter content are medium. Permeability is moderate, and runoff is very slow. The root zone is deep.

Included in mapping are small areas of Pratt loamy fine sand. Also included is a soil that has buried horizons of clay loam that extend to a depth of more than 60 inches, a few small areas of soils that have slopes of as much as 12 percent, and a few small areas of eroded soils.

This complex has medium potential for cultivated crops. The main limitations are medium fertility, the sandy texture, which makes the soils highly susceptible to wind erosion, and slope. This complex has high potential for use as pasture. A cropping system that includes crops that produce a large amount of residue which can be returned to the soil and that includes the use of fertilizer, cover crops, and stubble mulch helps to maintain fertility, control wind erosion, and increase the water intake rate.

These soils have medium potential for trees in windbreaks and post lots. The main limitations are medium fertility, medium available water capacity, and the sandy texture.

This complex has high potential for most urban uses. It has medium potential for small industrial buildings because of slope. This limitation can be overcome by land leveling.

This complex has medium potential for most recreation uses. The main limitation is the sandy texture which reduces the capacity of the soils to withstand heavy foot traffic. The soils are unstable and deteriorate easily. This limitation can be overcome by using a sod-type grass

cover. Good management is needed to keep the grass vigorous.

This complex has high potential for the development of habitat for openland wildlife such as red fox, rabbits, and quail. Capability unit IVe-5; Deep Sand range site.

18—Dill fine sandy loam, 1 to 3 percent slopes. This is a moderately deep, well drained, very gently sloping soil on uplands. Slopes are smooth and convex.

Typically, the surface layer is reddish brown fine sandy loam about 14 inches thick. The subsoil, to a depth of 33 inches, is reddish brown fine sandy loam. Red, weakly cemented sandstone that has thin bands of calcareous, dark red sandstone is below a depth of 33 inches.

Included in mapping are small areas of Binger fine sandy loam, Grandfield fine sandy loam, and Quinlan soils. Also included are a few areas of Dill soils that have slopes of 0 to 1 percent and a few areas of soils that have slopes of 3 to 5 percent.

The organic matter content and natural fertility are medium. Permeability is moderately rapid. Runoff is slow. The root zone is moderately deep.

This soil has high potential for cotton, small grains, grain sorghum, and wheat. It has high potential for hay and pasture. The main management concerns are controlling wind and water erosion and maintaining or improving soil structure and fertility. A cropping system that includes high-residue crops and that uses fertilizer, cover crops, stubble mulch, and minimum tillage helps to maintain or improve soil structure and fertility. It also helps to control wind and water erosion by maintaining a vegetative cover that protects the soil in windy periods, and by increasing the water intake rate, which in turn reduces runoff.

This soil has medium potential for trees in windbreaks and post lots.

This soil has high potential for most urban uses; however, it has a moderate limitation for dwellings with basements and a severe limitation for septic tank absorption fields. The main limitation is depth to bedrock. If dwellings with basements are to be built on this soil, the bedrock can be excavated, but excavation costs are often prohibitive. If this soil is used as a site for septic tank absorption fields, the limitation can be overcome by increasing the size of the absorption area or by modifying the filter field.

This soil has high potential for the development of recreation facilities such as picnic areas, campgrounds, playgrounds, and golf courses. It has high potential for the development of habitat for openland wildlife such as quail, rabbits, and doves. It produces an adequate amount of food and cover. Capability unit IIIe-2; Sandy Prairie range site.

19—Dill-Quinlan complex, 1 to 3 percent slopes. This complex consists of moderately deep and shallow, well drained, very gently sloping soils on uplands. The Dill and Quinlan soils are so intermingled that they could not be separated in mapping at the scale used. Slopes are smooth and convex.

Dill fine sandy loam makes up about 30 to 50 percent of each mapped area. Typically, the surface layer is reddish brown fine sandy loam about 10 inches thick. The subsoil, to a depth of 34 inches, is red fine sandy loam. Red, weakly consolidated sandstone is below a depth of 34 inches.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid. Runoff is slow. The root zone is moderately deep.

Quinlan fine sandy loam makes up about 20 to 30 percent of each mapped area. Typically, the surface layer is reddish brown fine sandy loam about 6 inches thick. The subsoil, to a depth of 14 inches, is red fine sandy loam. Red, weakly cemented sandstone is below a depth of 14 inches.

This soil is calcareous throughout. Natural fertility and the organic matter content are low. Permeability is moderately rapid. Runoff is medium. The available water capacity is low.

Included in mapping are small areas of Woodward silt loam. Also included are small areas of Binger fine sandy loam and Grandfield fine sandy loam and a few small areas of eroded soils.

This complex has medium to low potential for farming and for urban uses. Depth to bedrock and the low available water capacity are the main limitations.

This complex has medium to low potential for trees in windbreaks and post lots. The limitations are depth to bedrock and the low available water capacity.

This complex has high to medium potential for the development of habitat for openland wildlife. The Quinlan soil is limited by its shallowness to bedrock. This complex can produce a good to fair amount of food and cover. Capability unit IIIe-2; the Dill soil is in Sandy Prairie range site, the Quinlan soil is in Shallow Prairie range site.

20—Dill-Quinlan complex, 3 to 5 percent slopes. This complex consists of moderately deep and shallow, well drained, gently sloping soils on uplands. Slopes are smooth and convex. The Dill and Quinlan soils are so intermingled that they could not be separated in mapping at the scale used.

Dill fine sandy loam makes up about 25 to 45 percent of each mapped area. Typically, the surface layer is reddish brown fine sandy loam about 8 inches thick. The subsoil, to a depth of 32 inches, is red fine sandy loam that is underlain by red, weakly cemented sandstone.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid. Runoff is medium. The root zone is moderately deep.

Quinlan fine sandy loam makes up about 25 to 35 percent of each mapped area. Typically, the surface layer is reddish brown fine sandy loam about 6 inches

thick. The subsoil is red fine sandy loam about 8 inches thick. Red, weakly consolidated sandstone is at a depth of 14 inches.

This soil is calcareous throughout. Natural fertility and the organic matter content are low. Permeability is moderately rapid. Runoff is rapid. The available water capacity is low.

Included in mapping are small areas of Woodward silt loam, Binger fine sandy loam, and Grandfield fine sandy loam and a few small areas of eroded soils.

This complex has medium to low potential for farming and for most urban uses. Depth to bedrock and the low available water capacity are the main limitations.

This complex has medium to low potential for trees in windbreaks and post lots. The limitations are depth to bedrock and the low available water capacity.

This complex has high potential for most recreation uses; however, the Quinlan soil is limited for use as playgrounds because of its shallowness to rock.

This complex has high to medium potential as habitat for openland wildlife. The Quinlan soil is limited because of its shallowness to bedrock and low available water capacity. This complex can produce a good to fair amount of food and cover. Capability unit IVe-4; the Dill soil is in Sandy Prairie range site, the Quinlan soil is in Shallow Prairie range site.

21—Dill-Quinlan complex, 5 to 12 percent slopes. This complex consists of moderately deep and shallow, well drained, sloping to strongly sloping soils in canyons and swales and on hillsides and hilltops on uplands. Slopes are complex. The Dill and Quinlan soils are so intermingled that they could not be separated in mapping at the scale used.

Dill fine sandy loam makes up about 50 to 60 percent of each mapped area. Typically, the surface layer is reddish brown fine sandy loam about 7 inches thick. The subsoil is reddish brown fine sandy loam 21 inches thick. Red, weakly cemented sandstone is below a depth of 28 inches.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid. Runoff is rapid. The root zone is moderately deep.

Quinlan fine sandy loam makes up about 30 to 40 percent of each mapped area. Typically, the surface layer is reddish brown fine sandy loam about 7 inches thick. The subsoil is reddish brown fine sandy loam 12 inches thick. Red, weakly cemented sandstone is below a depth of 19 inches.

This soil is calcareous throughout. Natural fertility and the organic matter content are low. Permeability is moderately rapid. Runoff is rapid. The available water capacity is low.

Included in mapping are small areas of Woodward silt loam and a few outcrops of bedrock.

This complex has low potential for farming and for urban uses. The limitations are slope and the shallowness to bedrock of the Quinlan soils. They are very difficult to overcome.

This complex has low potential for trees in windbreaks and post lots. The major limitations are depth to bedrock and slopes.

This complex has medium potential for most recreation uses. The Quinlan soil is limited for use as playgrounds because of its shallowness to bedrock and slope.

This complex has medium potential for the development of habitat for openland wildlife. The Quinlan soil is limited because of slope, shallowness, and low available water capacity. This complex produces a fair to poor amount of food and cover. Capability unit VIe-2; the Dill soil is in Sandy Prairie range site, the Quinlan soil is in Shallow Prairie range site.

22—Dodson silt loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on smooth, broad upland terraces. Slopes mainly are convex. Areas are 15 to more than 160 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 19 inches thick. The upper part of the subsoil, which is 12 inches thick, is brown silty clay loam, and the lower part, to a depth of about 70 inches, is brown silty clay. Brown to reddish brown silty to clayey redbed sediment is below a depth of 70 inches.

Included in mapping are a few small areas of St. Paul, Carey, and Cornick soils.

Natural fertility is high. Permeability is moderately slow, and runoff is slow. The root zone is deep.

This soil has high potential for small grains, grain sorghum, and cotton. It has high potential for hay and pasture. Good tilth is maintained by returning crop residue to the soil. Erosion is a moderate hazard unless a vegetative cover is maintained to protect the soil. The use of winter cover crops following row crops and minimum tillage helps to reduce runoff and to control wind erosion.

If trees are grown in windbreaks and post lots, their survival rate generally is low, their growth is slow, and their life expectancy is short.

This soil has medium potential for most urban uses. The limitations are a moderate shrink-swell potential and low strength. They can be overcome by proper design and installation. The clayey subsoil, which is moderately slowly permeable, is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field.

This soil has medium potential for the development of recreation facilities such as camp areas and playgrounds because the moderately slow permeability of the clayey subsoil causes water to pond on the surface.

This soil has high potential for the development of habitat for openland wildlife such as quail, doves, and rabbits. It can produce an adequate amount of food and cover. Capability unit IIc-1; Hardland range site.

23—Dougherty-Eufaula complex, 3 to 8 percent slopes (W). This complex consists of deep, well drained, gently sloping to sloping soils on uplands in the eastern part of the county near Colony. The topography is undulating to hummocky. Dougherty and Eufaula soils in this complex are so intermingled that they could not be separated in mapping at the scale used.

Dougherty loamy fine sand makes up 40 to 60 percent of each mapped area. Typically, the surface layer is brown loamy fine sand about 6 inches thick. The subsurface layer is light brown loamy fine sand about 20 inches thick. The upper part of the subsoil, to a depth of 42 inches, is red sandy clay loam, and the lower part is red fine sandy loam that extends to a depth of 51 inches. Below that, light red loamy fine sand extends to a depth of 72 inches.

Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is slow. The root zone is deep.

Eufaula loamy fine sand makes up 25 to 40 percent of each mapped area. Typically, the surface layer is pale brown loamy fine sand about 8 inches thick. The subsurface layer is pink fine sand that extends to a depth of 40 inches. Below that, to a depth of 72 inches, the soil material is yellowish red fine sand that has thin reddish lamellae of loamy fine sand.

Natural fertility and the organic matter content are low. Permeability is rapid. Runoff is very slow. The root zone is deep. The available water capacity is low.

Included in mapping are small areas of a soil that is similar to this Dougherty soil but has a combined surface and subsurface layer less than 20 inches thick. Also included are a few small areas of a soil that has sandstone at a depth below 40 inches.

This complex has low potential for cultivated crops. It has high potential for use as permanent pasture. Wind erosion is a severe hazard if cultivated crops are grown. Maintaining soil structure and fertility are other management concerns. Maintaining a vegetative cover helps to control wind erosion. Growing high-residue crops and returning the residue to the soil help to maintain soil structure and fertility.

This complex has medium to low potential for trees in windbreaks and post lots.

This complex has high potential for most urban uses. It has low potential for sanitary landfills because the percolation rate is rapid in the sandy substratum, and contamination of underground water is a hazard. This limitation can be overcome by backfilling the lower part of the trench with slowly permeable soil material.

This complex has medium potential for most recreation uses. The limitation is the sandy texture which reduces the capacity of the soils to withstand intensive foot traffic.

These soils have medium potential for the development of habitat for openland wildlife. They produce a fair amount of food and cover for wildlife such as red fox, quail, and rabbits. Capability unit IVe-5; Deep Sand Savannah range site.

24—Grandfield fine sandy loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on uplands. Slopes are smooth and mainly are convex.

Typically, the surface layer is reddish brown fine sandy loam about 12 inches thick. In the upper part, the subsoil is reddish brown fine sandy loam about 6 inches thick; in the next part it is reddish brown sandy clay loam about 9 inches thick; at a depth of 27 inches the subsoil is red sandy clay loam; and in the lowermost part, to a depth of about 56 inches, it is red fine sandy loam. Below this, to a depth of 72 inches, the soil material is red fine sandy loam.

Included in mapping are small areas of Binger fine sandy loam and a soil that is similar to this Grandfield soil but has mottles below a depth of 20 inches. Also included are some ponded areas that mainly are less than 3 acres in size and a few small areas of soils that have buried horizons at a depth below 40 inches.

The organic matter content and natural fertility are medium. Permeability is moderate, and runoff is very slow. The soil material is easily penetrated by plant roots. The root zone is deep.

This soil has high potential for cultivated crops, hay, and pasture. Wind erosion is a moderate hazard if this soil is cultivated. The use of crop residue, minimum tillage, and stubble mulch helps to control wind erosion.

This soil has high potential for trees in windbreaks and post lots.

This soil has high potental for most urban and recreation uses. It has high potential for the development of habitat for openland wildlife such as red fox, doves, rabbits, and quail. Capability unit IIe-2; Sandy Prairie range site.

25—Grandfield fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, very gently sloping soil on uplands. Slopes are smooth and mainly are convex.

Typically, the surface layer is reddish brown fine sandy loam about 10 inches thick. The next layer is reddish brown fine sandy loam 8 inches thick. Between depths of 18 and 36 inches, the soil material is reddish brown sandy clay loam. Below that, it is red fine sandy loam that extends to a depth of 56 inches. Red fine sandy loam is below a depth of 56 inches.

Included in mapping are a few ponded areas that are mainly less than 3 acres in size. Also included are small areas of Binger fine sandy loam and a few areas of soils that have a buried horizon below a depth of 40 inches.

Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is slow. The root zone is deep.

This soil has high potential for cultivated crops, hay, and pasture. Wind and water erosion are a hazard if

cultivated crops are grown. Maintaining soil structure and fertility are other management concerns. A cropping system that includes the use of cover crops, fertilizer, crop residue, stubble mulch, and minimum tillage helps to control erosion and maintain soil structure and fertility.

This soil has high potential for trees in windbreaks and post lots.

This soil has high potential for most urban and recreation uses. It has high potential for the development of habitat for openland wildlife such as red fox, quail, and rabbits. Capability unit IIIe-2; Sandy Prairie range site.

26—Grandfield fine sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on rounded hilltops and hillsides and in swales, on uplands. Slopes are smooth and mainly are convex.

Typically, the surface layer is reddish brown fine sandy loam about 7 inches thick. The upper part of the subsoil is reddish brown fine sandy loam about 9 inches thick; the middle part is reddish brown sandy clay loam that extends to a depth of 35 inches; and the lower part, which is 20 inches thick, is red fine sandy loam. The substratum, at a depth below 55 inches, is red fine sandy loam.

Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is medium. The root zone is deep.

This soil has high potential for cultivated crops, hay, and pasture. Wind and water erosion are a moderate hazard if cultivated crops are grown. Maintaining soil structure and fertility are other management concerns. A cropping system that returns crop residue to the soil and that includes the use of fertilizer, cover crops, stubble mulch, and minimum tillage helps to control erosion and maintain soil structure and fertility.

This soil has medium potential for trees in windbreaks and post lots. Its potential is limited because of slope and the medium available water capacity.

This soil has high potential for most urban and recreation uses; however, slope is a moderate limitation to the development of small commercial buildings and playgrounds. This limitation can easily be overcome by land leveling.

This soil has high potential for the development of habitat for openland wildlife such as doves, rabbits, and quail. It produces fair seed crops and good cover. Capability unit IIIe-2; Sandy Prairie range site.

27—Hardeman fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, very gently sloping soil that generally is on upland foot slopes.

Typically, the surface layer and subsurface layer are reddish brown fine sandy loam about 14 inches thick. The subsoil is reddish brown fine sandy loam that extends to a depth of 50 inches. The substratum, below a depth of 50 inches, is reddish brown, calcareous, moderately alkaline fine sandy loam.

Included in mapping are small areas of Woodward silt loam and Reinach very fine sandy loam.

The organic matter content and natural fertility are medium. Permeability is moderately rapid, and runoff is slow. The soil material is easily penetrated by plant roots. The root zone is deep. Tilth is good and the soil can be worked within a wide range of moisture content.

This soil has high potential for cultivated crops, hay, and pasture. Erosion is a moderate hazard if cultivated crops are grown. A cropping system that returns crop residue to the soil and that includes the use of cover crops, fertilizer, minimum tillage, and stubble mulch helps to control erosion. It can also help to maintain soil structure and fertility.

This soil has high potential for trees in windbreaks and post lots and for most recreation uses.

This soil has high potential for most urban uses, but it has medium potential for local roads and streets. The main limitation is low strength.

This soil has high potential for the development of habitat for openland wildlife. It produces an adequate amount of cover and food. Capability unit IIIe-2; Sandy Prairie range site.

28—Hardeman fine sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on foot slopes and hillsides and in swales on uplands. Slopes mainly are concave.

Typically, the surface layer is brown fine sandy loam about 14 inches thick. The subsoil, to a depth of 50 inches, is reddish brown, mildly alkaline fine sandy loam. Below that, the substratum is reddish brown, calcareous, moderately alkaline fine sandy loam to a depth of 72 inches.

Included in mapping are a few small areas of Woodward silt loam, Shellabarger fine sandy loam, and Binger fine sandy loam.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid, and runoff is medium. The soil material is easily penetrated by roots. The root zone is deep.

This soil has medium potential for cotton, wheat, and grain sorghum. It has high potential for hay and pasture. Erosion is a moderate hazard if cultivated crops are grown. Maintaining soil structure and fertility are other management concerns. Winter cover crops following row crops, crop residue, stubble mulch, fertilizer, and minimum tillage help to control erosion and maintain soil structure and fertility.

This soil has high potential for trees in windbreaks and post lots.

This soil has high potential for most urban uses. It has low potential for sanitary landfills because of the hazard of seepage of liquid wastes, which can cause contamination of underground water. This limitation can be overcome by backfilling the bottom of the trench with impervious clayey material.

This soil has high potential for most recreation uses. It has medium potential for playground areas such as baseball diamonds or tennis courts, mainly because of slope. This limitation can be overcome by land leveling or smoothing.

This soil has high potential for the development of habitat for openland wildlife such as red fox, rabbit, quail, and doves. Capability unit IIIe-2; Sandy Prairie range site.

29—Hardeman fine sandy loam, 5 to 8 percent slopes. This is a deep, well drained, sloping soil on foot slopes and hillsides and in swales on uplands. Slopes mainly are concave.

Typically, the surface layer is reddish brown fine sandy loam about 13 inches thick. The subsoil, to a depth of 27 inches, is reddish brown fine sandy loam. Below this, reddish brown fine sandy loam extends to a depth of more than 69 inches.

Included in mapping are small areas of Woodward silt loam, Dill fine sandy loam, Quinlan fine sandy loam, and a few outcrops of bedrock.

The organic matter content is medium. Permeability is moderately rapid, and runoff is medium. The soil material is easily penetrated by plant roots. The root zone is deep.

This soil has low potential for cultivated crops. Its potential is limited because of slope and the severe erosion hazard. This soil has high potential for hay and pasture. Controlling erosion and maintaining soil structure and fertility are the main concerns of management. A cropping system that returns crop residue to the soil, that uses winter cover crops following row crops, and that uses fertilizer and stubble mulch helps to reduce erosion and maintain soil structure and fertility.

This soil has high potential for trees in windbreaks and post lots.

This soil has medium potential for some urban uses. Low strength due to the high silt content is a limitation for local roads and streets. Slope is a limitation for small commercial buildings. This limitation can be overcome by extensive shaping and cutting and filling.

This soil has high potential for most recreation uses. Slope is a limitation for playgrounds, baseball diamonds, and tennis courts, which require a nearly level surface.

This soil has high potential for the development of habitat for openland wildlife. It produces adequate food and cover. Capability unit IVe-4; Sandy Prairie range site.

30—Obaro silty clay loam, 1 to 3 percent slopes. This is a moderately deep, very gently sloping soil on uplands. Slopes are smooth and convex.

Typically, the surface layer is reddish brown silty clay loam about 8 inches thick. The subsoil is red silty clay loam 18 inches thick. Below a depth of 26 inches, the soil material is red silty clay loam that has many soft bodies and concretions of calcium carbonate. Consolidated redbed shale is below a depth of 38 inches.

Included in mapping are a few small areas of Carey silt loam and areas of a soil that does not have calcium carbonate accumulations. Also included are a few areas of soils that have weathered redbed shale within a depth of 20 inches.

Natural fertility and the organic matter content are high. Permeability is moderate. Runoff is medium. The root zone is moderately deep.

This soil has medium potential for cotton, wheat, grain sorghum, hay, and pasture. The main limitation is the silty texture of the surface layer, which causes the surface to crust and thus reduces the water intake rate. A cropping system that includes the use of high-residue crops, cover crops, and minimum tillage can increase the water intake rate, reduce runoff, and improve soil structure.

This soil has low potential for trees in windbreaks and post lots. The main limitations are depth to bedrock and the low available water capacity.

This soil has medium potential for most urban uses. The main limitation is the shrink-swell potential. It can be overcome by good design and careful installation.

This soil has medium potential for most recreation uses. The main limitation is the silty clay loam texture, which causes the soil to become slick and sticky when wet.

This soil has high potential for the development of habitat for openland wildlife such as quail, rabbits, and songbirds. Capability unit IIIe-1; Loamy Prairie range site.

31—Obaro silty clay loam, 3 to 5 percent slopes. This is a moderately deep, gently sloping soil on uplands. Slopes are smooth and mainly are convex.

Typically, the surface layer is red, calcareous silty clay loam about 8 inches thick. The next layer, to a depth of 22 inches, is red, calcareous silty clay loam. Below this, to a depth of 31 inches, the soil material is red, calcareous silty clay loam that is about 20 percent soft bodies and hard concretions of calcium carbonate. Redbed shale is below a depth of 31 inches.

Included in mapping are a few small areas of Carey silt loam and areas of a soil that is similar to this Obaro soil but has clay loam texture at a depth between 10 and 40 inches. Also included are a few areas of soils that have weathered redbed shale within a depth of 20 inches and a few areas of soils that have slopes of as much as 7 percent.

Natural fertility and the organic matter content are high. Permeability is moderate. Runoff is medium. The root zone is moderately deep.

This soil has medium potential for cultivated crops, hay, and pasture. The main limitation is the silty clay loam texture of the surface layer, which causes the surface to crust and thus reduces the water intake rate and increases runoff. Growing high-residue crops and returning the crop residue to the soil can help to increase the water intake rate and reduce runoff.

This soil has low potential for trees in windbreaks and post lots. The main limitations are depth to bedrock and the low available water capacity.

This soil has medium potential for most urban uses. The main limitation is the shrink-swell potential. It can be overcome by good design and careful installation.

This soil has medium potential for most recreation uses. The main limitations are the silty clay loam texture, which causes surface crusting, makes the soil poorly suited to intensive foot traffic, and causes the soil to dry out slowly after rain.

This soil has high potential for the development of habitat for openland wildlife such as red fox, quail, and rabbits. Capability unit IVe-3; Loamy Prairie range site.

32—Obaro silty clay loam, 2 to 5 percent slopes, eroded. This is a moderately deep, gently sloping, eroded soil on hillsides and in swales. Because of erosion, most of the topsoil has been lost, the subsoil is exposed in places, and many small rills and gullies have formed. Slopes are complex and are concave or convex.

Typically, the surface layer is red calcareous silty clay loam about 5 inches thick. In the upper part, to a depth of 17 inches, the subsoil is red silty clay loam; and in the lower part, to a depth of 36 inches, it is red silty clay loam that is 15 to 20 percent soft bodies and concretions of calcium carbonate. Stratified silty and clayey redbeds are below a depth of 36 inches.

Included in mapping are small areas of Cordell silty clay loam and Carey silt loam. A soil that is similar to this Obaro soil but has a clay loam subsoil makes up about 25 percent of the mapped areas. Also included are a few areas of gravelly soils and a few areas of soils that have slopes ranging to 7 percent.

Natural fertility and the organic matter content are low. Permeability is moderate. Runoff is medium. The root zone is moderately deep.

This soil has low potential for cultivated crops. The main limitations are low fertility, rapid surface runoff, and the silty clay loam texture, which causes surface crusting and a slow water intake rate and accelerates erosion. A cropping system that includes the use of high-residue crops and returns the crop residue to the soil and that uses fertilizer, cover crops, and stubble mulch can help to maintain fertility, reduce surface crusting, increase the water intake rate, and control erosion.

This soil has low potential for trees in windbreaks and post lots. The main limitations are low fertility and the low available water capacity.

This soil has medium potential for most urban uses. The main limitation is the shrink-swell potential. It can be overcome by good design and careful installation.

This soil has medium potential for most recreation uses. The main limitation is the silty clay loam texture, which causes poor trafficability when the soil is wet and causes the soil to dry out slowly after rain.

This soil has medium potential for the development of habitat for openland wildlife such as quail, rabbits, and doves. The main limitation is low fertility due to the eroded condition of this soil. This soil produces only a fair amount of food and cover for wildlife. Capability unit IVe-2; Loamy Prairie range site.

33—Pond Creek fine sandy loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on broad, high upland terraces. Slopes are smooth.

Typically, the surface layer is brown fine sandy loam about 10 inches thick. The upper part of the subsoil is brown silty clay loam 31 inches thick; the middle part, to a depth of 60 inches, is yellowish red silty clay loam; and the lower part, to a depth of 78 inches, is yellowish red silt loam.

Included in mapping are a few small areas of Shellabarger fine sandy loam, Hardeman fine sandy loam, and St. Paul silt loam. Also included are a few areas of soils that have a lighter colored surface layer.

Natural fertility and the organic matter content are high. Permeability is moderately slow, and runoff is slow. The root zone is deep.

This soil has high potential for cotton, wheat, grain sorghum, and peanuts and for hay and pasture. Wind erosion is a moderate hazard. Growing high-residue crops and returning the crop residue to the soil and the use of winter cover crops following row crops help to reduce wind erosion.

This soil has high potential for trees in windbreaks and post lots. It has medium potential for most urban uses; it has low potential for use as septic tank absorption fields because the subsoil has moderately slow permeability. This limitation can be overcome by increasing the size of the absorption area or by modifying the field.

This soil has medium potential for most recreation uses. The main limitations are the moderately slow permeability and slow runoff. A well designed and carefully installed surface drainage system can overcome these limitations.

This soil has high potential for the development of habitat for openland wildlife such as red fox, quail, doves, and rabbits. Capability unit I-1; Sandy Prairie range site.

34—Pond Creek fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on broad, high upland terraces. Slopes are smooth and convex.

Typically, the surface layer is brown fine sandy loam about 10 inches thick. The subsoil, to a depth of 34 inches, is dark brown silty clay loam; to a depth of 59 inches, it is reddish brown silty clay loam; and below that, it is reddish brown silt loam that extends to a depth of 72 inches or more.

Included in mapping are a few small areas of Shellabarger fine sandy loam, Hardeman fine sandy loam, and St. Paul silt loam.

Natural fertility and the organic matter content are high. Permeability is moderately slow, and runoff is slow. The root zone is deep.

This soil has high potential for cotton, wheat, and grain sorghum and for hay and pasture. Erosion is a moderate hazard. Maintaining soil structure and fertility are other management concerns. A cropping system that includes the use of crop residue, cover crops, fertilizer, minimum tillage, and stubble mulch helps to control erosion and to maintain soil structure and fertility.

This soil has high potential for trees in windbreaks and post lots. It has medium potential for most urban uses. It has low potential for use as septic tank absorption fields because the subsoil has moderately slow permeability. This limitation can be overcome by increasing the size of the absorption area or by modifying the filter field.

This soil has medium potential for most recreation uses. The main limitation is the moderately slow permeability. Water ponds on the surface after heavy rains. A well designed and carefully installed surface drainage system can overcome this limitation.

This soil has high potential for the development of habitat for openland wildlife such as red fox, rabbits, and quail. Capability unit IIe-2; Sandy Prairie range site.

35—Port silt loam. This is a deep, well drained, nearly level soil on flood plains that are occasionally flooded.

Typically, the surface layer is brown silt loam about 10 inches thick. Next, the soil material is reddish brown silty clay loam 30 inches thick. Below that, to a depth of 60 inches, the substratum is reddish brown silt loam.

Included in mapping are a few areas of Clairemont silt loam and Woodward silt loam. Also included are small areas of Port silty clay loam.

Natural fertility and the organic matter content are high. Permeability is moderate. Runoff is slow. The root zone is deep.

This soil has high potential for cotton, grain sorghum, and wheat and for hay and pasture. Occasional flooding is a hazard. If this soil is grazed or tilled when wet, the surface compacts. Growing high-residue crops and returning the crop residue to the soil and the use of winter cover crops following row crops help to maintain soil structure. Flood control structures and farm ponds have been constructed in upstream watersheds to help reduce flooding.

This soil has high potential for trees in windbreaks and post lots.

This soil has low potential for most urban uses. The main limitation is the hazard of flooding (fig. 2).

This soil has low to medium potential for most recreation uses because of the flood hazard. Surface drainage is a problem during rainy periods because of the slow runoff.

This soil has high potential for the development of habitat for openland wildlife such as red fox, rabbits, quail, and doves. It can produce adequate food and cover. Capability unit IIw-1; Loamy Bottomland range site.

36—Pratt loamy fine sand, 5 to 12 percent slopes (W). This is a deep, well drained, sloping to strongly sloping soil on hummocky uplands. The relief is uneven and consists of low dunes separated by narrow valleys.

Typically, the surface layer is reddish brown loamy fine sand about 10 inches thick. The subsoil, to a depth of 18 inches, is reddish brown loamy fine sand and is slightly more clayey than the surface layer. Below that, the soil material is yellowish red loamy fine sand that extends to a depth of more than 72 inches.

Included in mapping are a few areas of Devol loamy fine sand.

The organic matter content and natural fertility are low. Permeability is rapid. Runoff is slow. The root zone is deep.

This soil has low potential for cultivated crops. The main limitations are low fertility, strong slopes, and the severe hazard of erosion. This soil is best suited to permanent grasses, which provide protection from erosion.

This soil has medium potential for trees in windbreaks and post lots. The main limitations are low fertility, low available water capacity, and slope. Some trees can be grown, and growth is fair.

This soil has low potential as a site for sanitary facilities such as sewage lagoons and sanitary landfills because the seepage of liquid wastes is a hazard. It has medium potential for dwellings, small commercial buildings, and other urban uses because of slope.

This soil has medium potential for most recreation uses. The main limitation is the sandy texture which can cause the soil and its vegetative cover to deteriorate if subjected to heavy foot traffic. Slope is a limitation for playgrounds.

This soil has medium potential for the development of habitat for openland wildlife such as quail, rabbits, and doves. It can produce only a fair amount of food and cover. Capability unit VIe-6; Deep Sand range site.

37—Quinlan-Obaro complex, 5 to 12 percent slopes. This complex consists of shallow and moderately deep, well drained, sloping and strongly sloping soils on ridge crests and hillsides and along canyons in the uplands. The Quinlan and Obaro soils are so intermingled that they could not by separated in mapping at the scale used.

Quinlan loam makes up 50 to 65 percent of each mapped area. Typically, the surface layer is reddish brown calcareous loam about 6 inches thick. The sub-

soil, to a depth of 17 inches, is red calcareous loam. Below that, the soil material is light red calcareous sandy siltstone.

Natural fertility and the organic matter content are low. Permeability is moderately rapid, and runoff is rapid. The available water capacity is low. The root zone is shallow.

Obaro silty clay loam makes up 20 to 35 percent of each mapped area. Typically, the surface layer is reddish brown calcareous silty clay loam about 8 inches thick. The subsoil, to a depth of 23 inches, is red calcareous silty clay loam; and to a depth of 33 inches it is red calcareous silty clay loam that has a few soft bodies of calcium carbonate. Red calcareous shale is below a depth of 33 inches.

Natural fertility and the organic matter content are high. Permeability is moderate. Runoff is rapid. The root zone is moderately deep.

Included in mapping are some small areas of Carey silt loam and some rock outcrops. Also included are a few areas of Cordell silty clay loam.

This complex has very low potential for cultivated crops, hay, and pasture. The major limitations are depth to bedrock, slope, and the low available water capacity. These soils are best suited to native grass.

This complex has low potential for trees in windbreaks and post lots because these soils are too shallow, too steep, and too droughty.

This complex has low potential for most urban and recreation uses. The main limitations are depth to bedrock and slope. This complex has high potential for development of natural scenic areas.

This complex has medium potential for the development of habitat for openland wildlife such as doves, quail, and rabbit. The soils can produce a fair amount of food and cover. Capability unit VIe-4; the Quinlan soil is in Shallow Prairie range site, the Obaro soil is in Loamy Prairie range site.

38—Quinlan-Rock outcrop complex, 8 to 20 percent slopes. This complex consists of shallow, well drained, sloping to steep soils and outcrops of sandstone. The areas of this complex are on ridge crests, in swales, and along canyon escarpments on uplands. Slopes mainly are 8 to 20 percent, but they range to 45 percent on the escarpments. The Quinlan soils and Rock outcrop are so intermingled that they could not be separated in mapping at the scale used.

Quinlan soils make up 30 to 50 percent of each mapped area. Typically, the surface layer is reddish brown calcareous loam about 6 inches thick. The subsoil, which extends to a depth of 15 inches, is red calcareous loam. Red sandstone that has concretions or threads of calcium carbonate in crevices of the sandstone is below a depth of 15 inches.

Natural fertility and the organic matter content are low. Permeability is moderately rapid, and runoff is rapid. The available water capacity is low. The root zone is shallow.

Rock outcrop makes up 25 to 50 percent of each mapped area. In some areas of Rock outcrop, a 3 inch layer of reddish brown calcareous fine sandy loam overlies the red calcareous sandstone. Runoff is rapid.

Included in mapping are a few small areas of Hardeman very fine sandy loam and St. Paul silt loam.

This complex has low potential for farming because of the shallowness to rock, sandstone outcrops, and steep slopes. It is best suited to native grass.

This complex has low potential for urban uses and for trees in windbreaks and post lots. The main limitations are shallowness to bedrock and steep slopes.

This complex has low potential for most recreation uses, but it has high potential for the development of natural scenic areas.

This complex has low potential for the development of habitat for openland wildlife such as red fox, quail, and rabbits because it cannot produce adequate food and cover. Capability unit VIIs-2; the Quinlan part is in Shallow Prairie range site, the Rock outcrop part was not assigned to a range site.

39—Quinlan-Woodward complex, 2 to 5 percent slopes, eroded. This complex consists of shallow and moderately deep, well drained, gently sloping, eroded soils on ridge crests and hillsides and in drainageways on uplands. Because of erosion, most of the topsoil has been lost, the subsoil is exposed in places, and small rills and gullies have formed. The Quinlan and Woodward soils are so intermingled that they could not be separated in mapping at the scale used.

Quinlan loam makes up 60 to 75 percent of each mapped area. Typically, the surface layer is yellowish red loam about 4 inches thick. The subsoil is red loam that extends to a depth of 14 inches. It is underlain by light red, weakly consolidated sandy siltstone.

Natural fertility and the organic matter content are low. Permeability is moderately rapid. Runoff is rapid. The available water capacity is low, and the root zone is shallow.

Woodward loam makes up 20 to 35 percent of each mapped area. Typically, the surface layer is reddish brown calcareous loam about 6 inches thick. The subsoil, which extends to a depth of 24 inches, is yellowish red calcareous loam. It is underlain by reddish yellow, calcareous sandy siltstone.

Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is medium. The root zone is moderately deep.

Included in mapping are a few gullied areas and areas where bedrock outcrops.

These soils have low potential for cultivated crops. Depth to bedrock and the low available water capacity are the main limitations. These soils have medium potential for use as tame grass pasture. The main limitations are depth to bedrock, medium to rapid runoff, and the erosion hazard. Maintaining a permanent grass cover

helps to increase the water intake rate and to decrease runoff and erosion.

These soils have low to medium potential for trees in windbreaks and post lots. The Quinlan soil is not suited to trees because it has a shallow root zone and low available water capacity. The moderately deep Woodward soil is suitable for selected trees, but the low available water capacity is a limitation.

This complex has low potential for most urban uses. The major limitation is depth to rock.

This complex has medium potential for most recreation uses. The main limitation is depth to bedrock. For playgrounds, slope is also a limitation.

This complex has medium potential for the development of habitat for openland wildlife. The main limitation is the low to medium available water capacity, which reduces the amount of food and cover for wildlife such as quail, doves, and rabbits. Capability unit IVe-2; Quinlan soil is in Shallow Prairie range site, the Woodward soil is in Loamy Prairie range site.

40—Quinlan-Woodward complex, 5 to 12 percent slopes. This complex consists mainly of small areas of shallow and moderately deep, well drained, sloping and strongly sloping soils on ridge crests and hillsides on uplands. In some areas along canyon escarpments, slopes are steeper. The Quinlan and Woodward soils are so intermingled that they could not be separated in mapping at the scale used.

Quinlan loam makes up 45 to 60 percent of each mapped area. Typically, the surface layer is reddish brown calcareous loam about 6 inches thick. The subsoil, which extends to a depth of 19 inches, is red calcareous loam. Light red calcareous sandy siltstone is below a depth of 19 inches.

Natural fertility and the organic matter content are low. Permeability is moderately rapid, and runoff is rapid. The available water capacity is low, and the root zone is shallow.

Woodward loam makes up 20 to 35 percent of each mapped area. Typically, the surface layer is reddish brown calcareous loam about 8 inches thick. The subsoil, which extends to a depth of 32 inches, is yellowish red calcareous loam. It is underlain by red calcareous sandy siltstone.

Natural fertility and the organic matter content are medium. Permeability is moderate. Runoff is medium to rapid, depending on the slope. The root zone is moderately deep.

Included in mapping are small areas of Carey silt loam, Obaro silty clay loam, and Rock outcrop.

This complex has low potential for cultivated crops, hay, and pasture. The major limitations are depth to bedrock, slope, and the low available water capacity. These soils are best suited to native grass.

This complex has low potential for trees in windbreaks and post lots because the soils are too shallow, steep, and droughty.

This complex has low potential for most urban and recreation uses because of the depth to bedrock and slope. It has high potential for the development of natural scenic areas.

This complex has medium potential for the development of habitat for openland wildlife such as doves, quail, and rabbit. It can produce a fair amount of food and cover. Capability unit VIe-4; the Quinlan soil is in Shallow Prairie range site, the Woodward soil is in Loamy Prairie range site.

41—Quinlan and Dill soils, 2 to 12 percent slopes, severely eroded. This map unit consists of shallow and moderately deep, very gently sloping to strongly sloping soils on ridgetops, hillsides, and along drainageways on uplands. These soils have a surface layer that has been thinned by erosion and is winnowed. Rills and gullies are common.

This unit is made up of Quinlan soils and Dill soils intermingled in an irregular pattern. Individual areas of these soils are large enough to be mapped separately, but because of their present and predicted use the soils were not separated in mapping. Most mapped areas consist of both Quinlan and Dill soils; a few areas consist only of one or the other soil. A typical area consists of about 70 percent Quinlan soils, 20 percent Dill soils, 5 percent Woodward soils, and 5 percent Rock outcrop.

Typically, Quinlan soils have a surface layer of reddish brown, calcareous fine sandy loam about 5 inches thick. Below this, a layer of red, calcareous fine sandy loam extends to a depth of 16 inches. Red, calcareous sandstone is below a depth of 16 inches.

Quinlan soils are low in natural fertility and organic matter content. Permeability is moderately rapid. Runoff is rapid. The root zone is shallow.

Typically, Dill soils have a reddish brown fine sandy loam surface layer about 5 inches thick. The subsoil, to a depth of 27 inches, is reddish brown fine sandy loam. It is underlain by red, noncalcareous sandstone.

Dill soils are medium in organic matter content and natural fertility. Permeability is moderately rapid. Runoff is slow. The root zone is moderately deep.

These soils have low potential for cultivated crops, hay, and pasture. They are best suited to native grasses. The main limitations are depth to bedrock, low fertility, low available water capacity, and a severe hazard of erosion.

These soils have low potential for trees because of depth to bedrock and the low available water capacity. They have low potential for most urban uses mainly because of depth to rock, low fertility, and a severe hazard of erosion.

These soils have low potential for most recreation uses. The major limitations are depth to rock, slope, and

a severe hazard of erosion. They have low to medium potential for use as habitat for openland wildlife such as quail, doves, and rabbits because they do not produce adequate food and cover. Capability unit Vle-3; Eroded Prairie range site.

42—Reinach silt loam. This is a deep, well drained, nearly level soil on low stream terraces. This soil is flooded once in about 10 years or more. Slopes are plane to slightly convex.

Typically, the surface layer is brown silt loam about 8 inches thick. The layer below that is reddish gray silt loam about 20 inches thick. The subsoil is reddish brown silt loam and extends to a depth of 39 inches. Below that, to a depth of 74 inches, the soil material is reddish brown silt loam.

Included in mapping are a few small areas of soils that have a fine sandy loam overburden 9 to 28 inches thick and some small areas of Port silt loam and Hardeman fine sandy loam.

Natural fertility and the organic matter content are high. Permeability is moderate, and runoff is slow. The root zone is deep, and the soil material is easily penetrated by plant roots.

This soil has high potential for small grains, grain sorghum, cotton, hay, and pasture. Good tilth is maintained by returning crop residue to the soil.

This soil has high potential for trees in windbreaks and post lots.

This soil has high potential for most urban uses in the higher terrace areas that are never flooded. In the lower terrace areas, which are subject to rare flooding, this soil has low potential for urban uses.

This soil has high potential for most recreation uses; however, on low terraces that are subject to flooding it has medium potential for camping areas.

This soil has high potential for the development of habitat for openland wildlife such as quail, songbirds, and rabbits. It produces an adequate amount of food and cover. Capability unit I-2; Loamy Bottomland range site.

43—Retrop silty clay loam. This is a deep, somewhat poorly drained, nearly level soil on the flood plains of tributary streams throughout the county. It is flooded frequently for brief periods. The water table fluctuates, but it generally is within a depth of 2 1/2 to 4 feet. The recent clogging of pronounced channels has caused the water table to rise.

Typically, the surface layer is reddish brown, calcareous silty clay loam about 7 inches thick. To a depth of 30 inches the soil material is reddish brown, calcareous silt loam. Below that, it is reddish brown, calcareous silty clay loam that extends to a depth of more than 64 inches.

Included in mapping are a few areas of a soil that is less than 18 percent clay and that is noncalcareous in the upper 24 inches. Also included are a few areas of Dill and Quinlan soils that have trapped drainageways which result in a high water table.

Natural fertility is high. Permeability is moderate. Runoff is slow. The depth of the root zone varies according to the depth to water.

This soil has low potential for cultivated crops. The main limitations are the high water table and the hazard of flooding. This soil is well suited to use as pasture and to native grasses.

This soil has low potential for trees in windbreaks and post lots. The major limitation is the high water table.

This soil has low potential for most urban and recreation uses. The major limitations are the high water table and the hazard of flooding.

This soil has low potential for the development of habitat for openland wildlife such as rabbits, quail, and doves. The main limitations are the high water table and the hazard of flooding. Capability unit Vw-1; Subirrigated range site.

44—Shellabarger fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, very gently sloping soil on upland terraces above the Washita River. Slopes are smooth and convex. The areas are broad.

Typically, the surface layer is reddish brown fine sandy loam about 11 inches thick. The upper part of the subsoil is reddish brown sandy clay loam 15 inches thick, and the lower part is yellowish red fine sandy loam that extends to a depth of 48 inches. Below that, the soil material is reddish yellow fine sandy loam.

Included in mapping are a few small areas of Pond Creek fine sandy loam, Binger fine sandy loam, and Hardeman fine sandy loam. Also included are a few areas of soils that have a gravelly fine sandy loam surface layer and some gravel in the subsoil.

Natural fertility and the organic matter content are moderate. Permeability is moderate. Runoff is medium. Tilth is good, and this soil can be worked within a wide range of moisture conditions. The root zone is deep and the soil material is easily penetrated by plant roots.

This soil has high potential for row crops and small grains. It also has high potential for use as pasture and for hay crops. It responds well to fertilizer. Good tilth is maintained by returning crop residue to the soil. Erosion by wind or water is a moderate hazard if cultivated crops are grown. Minimum tillage and the use of cover crops help to reduce runoff and control wind erosion.

This soil has high potential for farmstead windbreaks and post lots.

This soil has high potential for most urban uses. It has few limitations as a site for dwellings, light industrial buildings, sanitary landfills, and septic tank filter fields because of its depth, gentle slopes, loamy texture, and moderate permeability.

This soil has high potential for recreation uses such as camp areas, picnic areas, playgrounds, and paths and trails.

This soil has high potential for the development of habitat for openland wildlife such as quail, rabbits, and songbirds because it can produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Capability unit IIe-2; Sandy Prairie range site.

45—Shellabarger fine sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on upland alluvial terraces above the Washita River. Slopes are smooth and convex. The areas generally are long and narrow to wide in shape, and they average more than 50 acres in size.

Typically, the surface layer is reddish brown fine sandy loam about 13 inches thick. It is winnowed in the upper 8 inches. The upper part of the subsoil, to a depth of 18 inches, is reddish brown sandy clay loam; the middle part, to a depth of 42 inches, is red sandy clay loam; and the lower part, to a depth of 53 inches, is red fine sandy loam. Below that, the substratum is red fine sandy loam that extends to a depth of 75 inches.

Included in mapping are small areas of Binger fine sandy loam and Hardeman fine sandy loam. Also included are small areas of a soil that has a gravelly fine sandy loam surface layer and some gravel in the subsoil.

Natural fertility and the organic matter content are moderate. Permeability is moderate. Runoff is medium. Tilth is good. The root zone is deep and the soil material is readily penetrated by plant roots.

This soil has high potential for row crops and small grains. It also has high potential for use as pasture and for hay crops. It responds well to fertilizer that is applied according to recommendations from soil tests. Good tilth is maintained by returning crop residue to the soil. Erosion by wind or water is a moderate hazard if cultivated crops are grown. Minimum tillage and the use of cover crops help to reduce runoff and control wind erosion.

This soil has high potential for trees in farmstead windbreaks and post lots.

This soil has high potential for most urban uses. It has high potential for recreation uses such as camp areas, picnic areas, playgrounds, and golf courses.

This soil has high potential for the development of habitat for openland wildlife such as quail, doves, and rabbits because it can produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Capability unit IIIe-2; Sandy Prairie range site.

46—St. Paul silt loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on uplands. Slopes are smooth and mainly are convex. Some areas are more than 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 16 inches thick. In the upper 5 inches the subsoil is brown silty clay loam; to a depth of 38 inches it is reddish brown silty clay loam; and in the lower part, to a depth of 42 inches, it is light reddish brown, calcareous silty clay loam. Below that, the substratum is light reddish brown, calcareous silt loam that extends to a depth of 60 inches.

Included in mapping are a few small areas of Pond Creek soils and Carey soils. Also included are a few outcrops of bedded gypsum that are less than one-half acre in size.

Natural fertility and the organic matter content are high. Permeability is moderately slow. Runoff is slow. Tilth is good. The root zone is deep.

This soil has high potential for wheat, grain sorghum, and cotton and for hay and pasture crops. It responds well to fertilizer. Growing high-residue crops and returning the crop residue to the soil help to maintain fertility and good tilth and to increase the water intake rate.

This soil has moderate limitations for trees in windbreaks and post lots. Tree growth is somewhat restricted by the moderately slow permeability of the subsoil.

This soil has medium potential for most urban uses. The main limitation for houses and small commercial buildings is the shrink-swell potential. This limitation can be overcome by good design and careful installation. The main limitation for use as septic tank absorption fields is the moderately slow permeability of the subsoil. This limitation can be overcome by increasing the size of the absorption area or by modifying the field.

This soil has high potential for most recreation uses. It is well suited to the development of facilities such as campgrounds, picnic areas, and playing fields because of its loamy texture and the nearly level slopes.

This soil has high potential for the development of habitat for openland wildlife such as quail, doves, and rabbits because it can produce an adequate amount of food and cover. Capability unit IIe-1; Loamy Prairie range site.

47—St. Paul silt loam, 1 to 3 percent slopes. This is a very gently sloping soil on smooth, convex uplands. The areas generally are broad, and some are more than 200 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. In the upper few inches the subsoil is brown silty clay loam; below that it is reddish brown silty clay loam that extends to a depth of 50 inches; and in the lower part it is reddish brown clay loam that extends to a depth of 60 inches or more.

Included in mapping are a few small areas of Carey soils, Tillman soils, Pond Creek soils, and a few small areas of gypsum outcrops.

Natural fertility and the organic matter content are high. Permeability is moderately slow. Runoff is medium. Tilth is good. The root zone is deep.

This soil has high potential for wheat, cotton, grain sorghum, and pasture and hay crops. It responds well to fertilizer that is applied at the time and rate indicated by soil tests. Water erosion is a moderate hazard. Soil fertility needs to be maintained. Growing high-residue crops and returning the crop residue to the soil (fig. 3) can help

to increase the water intake rate, reduce erosion, and maintain fertility.

This soil has medium potential for trees in windbreaks and post lots. The compact subsoil and the moderately slow permeability limit tree growth; however, some tree species can attain fair growth.

This soil has medium potential for most urban uses such as sites for houses, small industrial buildings, septic tank absorption fields, sanitary landfills, and local roads and streets. The limitations to urban use are the moderately slow permeability, low strength, and the shrink-swell potential. Most of these limitations can be overcome by good design and careful installation.

This soil has high potential for most recreation uses, including golf courses.

This soil has high potential for the development of habitat for openland wildlife, such as quail, doves, and rabbits. It can produce good food and cover. Capability unit IIe-1; Loamy Prairie range site.

48—St. Paul silt loam, 3 to 5 percent slopes. This is a gently sloping soil on smooth, convex uplands. It generally is on hillsides adjacent to the less sloping St. Paul soils. The areas are long and narrow and generally are not more than 50 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil extends to a depth of 42 inches. In the upper few inches it is brown silty clay loam and it grades to firm reddish brown silty clay loam. Below that, the soil material is reddish brown clay loam that extends to a depth of 60 inches or more.

Included in mapping are a few small areas of Carey, Woodward, and Quinlan soils and a few small outcrops of gypsum.

Natural fertility and the organic matter content are moderate to high. Permeability is moderately slow. Runoff is medium. The root zone is deep.

This soil has moderate to high potential for wheat, grain sorghum, cotton, hay, and pasture crops. The soil responds well to fertilizer. Maintaining soil fertility and soil structure and preventing water erosion are the main management concerns. The use of stubble mulch, minimum tillage, and high-residue crops and returning the crop residue to the soil can help to maintain soil fertility and soil structure, to increase the water intake rate, and to reduce runoff.

This soil has low potential for trees in windbreaks and post lots. The slope, the compact subsoil, and the moderately slow permeability limit tree growth; however, some tree species can attain fair growth.

This soil has medium potential for most urban uses. The limitations to the use of this soil as sites for houses and small industrial buildings are its shrink-swell potential and low strength. They can be overcome by good design and careful installation. The moderately slow percolation rate is a limitation for septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption area or by modifying the field.

This soil has high potential for most recreation uses, including camp areas, picnic areas, hiking or riding trails, and golf courses. The slope is a limitation for playgrounds. This soil has high potential for the development of habitat for openland wildlife such as quail, doves, and rabbits. It produces good food and cover. Capability unit IIIe-1; Loamy Prairie range site.

49—Vernon-Rock outcrop complex, 2 to 12 percent slopes. This complex consists of moderately deep, well drained, gently sloping to strongly sloping soils and outcrops of red shale on uplands. It is on hilltops and hillsides, in swales, and on canyon escarpments in the red clay uplands. The Vernon soils and Rock outcrop are so intermingled that they could not be separated in mapping at the scale used.

Vernon soils make up 50 to 60 percent of each mapped area. Typically, the surface layer is dark brown silty clay loam about 6 inches thick. The subsoil is weak red calcareous clay that extends to a depth of 26 inches. Below that, the soil material is reddish brown, massive clay that has common bands or streaks of olive gray clay.

Natural fertility and the organic matter content are medium. The soil material typically is calcareous throughout. Permeability is very slow, and runoff is rapid. The available water capacity is low. The root zone is moderately deep.

Rock outcrop makes up 20 to 30 percent of each mapped area. Typically, it is weak red, massive, clayey shale about 12 inches thick that is underlain by 2- to 12-inch thick strata of olive gray shale interbedded with red shale.

Included in mapping are small isolated areas, generally less than 3 acres in size, of Obaro silty clay loam and St. Paul silt loam.

This complex has low potential for small grains and row crops because of the very slow permeability, the slope, and the hazard of erosion. It is best suited to native grasses. The areas of Rock outcrop can produce only a small amount of vegetation because of the massive shale strata. In areas of Vernon soils, a cover of native grass can protect the soil from erosion and increase the water intake for plants.

This complex has severe limitations for trees in farmstead windbreaks and post lots because the clayey soils are droughty and runoff is rapid.

This complex has low potential for most urban uses. The high shrink-swell potential and the low bearing capacity are limitations for dwellings, light industrial buildings, and local roads and streets, but they can be overcome by good design and careful installation. The Vernon soils have very slow permeability, which is a limitation for septic tank filter fields.

This complex has low potential for recreation uses. The sticky surface texture and the very slow permeability are limitations for camp areas, picnic areas, playgrounds, and paths and trails.

This complex has medium potential for the development of habitat for openland wildlife such as quail, rabbits, and doves. The soils can produce a fair amount of food and cover for a small wildlife population. Capability unit VIIs-1; Vernon part is in Red Clay Prairie range site, Rock outcrop part not assigned to a range site.

50—Woodward silt loam, 1 to 3 percent slopes. This is a moderately deep, well drained, very gently sloping soil on uplands. Slopes are plane and mainly convex.

Typically, the surface layer is reddish brown, calcareous silt loam about 10 inches thick. The subsoil, which extends to a depth of 36 inches, is red, calcareous silt loam that has a few films of soft secondary lime. Red, calcareous silty sandstone is below a depth of 36 inches.

Included in mapping are a few small areas of Dill fine sandy loam, Hardeman fine sandy loam, and Quinlan loam.

Natural fertility is high, and the organic matter content is medium. Permeability is moderate, and runoff is medium. The root zone is moderately deep.

This soil has high potential for cotton, wheat, grain sorghum, hay, and pasture. The erosion hazard is moderate if cultivated crops are grown. The main management concerns are maintaining soil fertility and controlling erosion. Growing high-residue crops and returning the crop residue to the soil can help to maintain the organic matter content and reduce runoff.

This soil has medium potential for trees in windbreaks and post lots. The main limitation is depth to bedrock.

This soil has medium potential for urban uses, including the construction of small commercial buildings and dwellings. The main limitation is low strength.

This soil has a high potential for all recreation uses and for the development of habitat for openland wildlife such as red fox, quail, and rabbits. Capability unit IIe-1; Loamy Prairie range site.

51—Woodward silt loam, 3 to 5 percent slopes. This is a moderately deep, well drained, gently sloping soil on uplands. Slopes are plane and mainly convex.

Typically, the surface layer is reddish brown silt loam about 8 inches thick. The upper part of the subsoil, to a depth of 26 inches, is light reddish brown silt loam; and the lower part, to a depth of 38 inches, is red silt loam. Red, weakly consolidated silty sandstone is below a depth of 38 inches.

Included in mapping are a few small areas of Quinlan loam, Dill fine sandy loam, and Hardeman fine sandy loam. Also included are small areas of a soil that is similar to this Woodward soil except that it has sandstone at a depth between 40 and 50 inches.

Natural fertility is high, and the organic matter content is medium. Permeability is moderate, and runoff is medium. The root zone is moderately deep.

This soil has high potential for cotton, wheat, grain sorghum, hay, and pasture. The erosion hazard is moderate if cultivated crops are grown. The main management concerns are maintaining soil fertility and controlling erosion. A cropping system that includes crops that produce a large amount of residue that can be returned to the soil and that includes the use of fertilizer, cover crops, and stubble mulch can help to maintain soil fertility, increase the water intake rate, and reduce wind erosion and runoff.

This soil has medium potential for trees in farmstead windbreaks and post lots. The depth to bedrock and the medium available water capacity are the main limitations.

This soil has medium potential for urban uses, including the construction of dwellings and small commercial buildings. The limitation is low strength.

This soil has high potential for most recreation uses, but it has medium potential for recreation facilities such as baseball diamonds and tennis courts. The limitation is slope, but it can be overcome by leveling or smoothing.

This soil has high potential for the development of habitat for openland wildlife such as rabbits, quail, and red fox. Capability unit IIIe-1; Loamy Prairie range site.

52—Woodward silt loam, 5 to 8 percent slopes. This is a moderately deep, well drained, sloping soil on uplands. Slopes are plane to convex.

Typically, the surface layer is reddish brown, calcareous silt loam about 7 inches thick. To a depth of 26 inches, the subsoil is light reddish brown, calcareous silt loam; below that, to a depth of 36 inches, it is red, calcareous silt loam that has a few films of soft secondary lime. Red, calcareous silty sandstone is below a depth of 36 inches.

Included in mapping are a few areas of Quinlan loam and a few areas of eroded Woodward soils that have a thinned surface layer and a few rills and small gullies.

Natural fertility is high, and the organic matter content is medium. Permeability is moderate, and runoff is medium. The root zone is moderately deep.

This soil has medium potential for grain sorghum and wheat. The main limitations are slope and the hazard of erosion. This soil has medium potential for hay and pasture crops. The use of high-residue crops, fertilizer, cover crops, and stubble mulch in combination with terraces and contour tillage can help to control erosion.

This soil has medium potential for trees in windbreaks and post lots. The depth to bedrock and the medium available water capacity are the main limitations.

This soil has medium potential for most urban uses. The limitation to constructing houses and small commercial buildings is low strength.

This soil has high potential for most recreation uses; however, slope is a limitation for recreation facilities,

including baseball diamonds and tennis courts, that require large, nearly level areas.

This soil has high potential for the development of habitat for openland wildlife such as quail, songbirds, and rabbits. It can produce a sufficient quantity of food and cover. Capability unit IVe-3; Loamy Prairie range site.

53—Woodward-Clairemont complex. This complex consists mainly of moderately deep and deep, well drained soils in narrow drainageways that cut into smoother upland areas. The Woodward and Clairemont soils are so intermingled that they could not be separated in mapping at the scale used. They are on steep breaks and sloping side slopes and on colluvial slopes and narrow bottom lands. The bottom lands have defined drainage channels in some areas. The valley sides and valley floors are too narrow for mapping and management.

The areas of this complex range from 100 to 750 feet in width and from 1/2 to 2 1/2 miles in length, and they are scattered throughout the county. Slopes range from 3 to 45 percent on the breaks and from 0 to 7 percent on the bottom lands. Most of the side slopes are in native grasses, and the alluvial areas are in grasses and scattered hardwoods.

Woodward loam is the dominant soil on the side slopes. It makes up about 66 percent of the mapped areas. Typically, the surface layer is reddish brown, calcareous loam about 8 inches thick. The subsoil, which extends to a depth of 32 inches, is red, calcareous silt loam. Red, calcareous, weakly cemented sandstone is below a depth of 32 inches.

Natural fertility and the organic matter content are medium. Permeability is moderate, and runoff is medium. The available water capacity is medium, and the root zone is moderately deep.

Clairemont silt loam and other similar soils are the main soils on the bottom lands. They make up about 34 percent of each mapped area. Clairemont silt loam makes up about 24 percent of the complex. Typically, the surface layer is reddish brown, calcareous silt loam about 9 inches thick. The soil material between depths of 9 and 44 inches is reddish brown calcareous silt loam stratified with thin lenses of very fine sandy loam and loam. Below a depth of 44 inches, the soil material is reddish brown calcareous loam.

Natural fertility is high. Permeability is moderate. The root zone is deep. This soil is subject to frequent overflow.

Included in the mapped areas of Woodward loam on the side slopes are areas of Quinlan loam, Cordell silty clay loam, and Cornick silt loam. Also included are a few areas of Hardeman very fine sandy loam, Carey silt loam, St. Paul silt loam, and Obaro silty clay loam.

Included in the mapped areas of Clairemont silt loam are small areas of Retrop silty clay loam and Yahola fine sandy loam.

The soils in this complex have low potential for cultivated crops and hay. The major limitations are the hazard of frequent overflow on the Clairemont soils and the steep slopes of the Woodward soils. Some of the more gently sloping soils are suited to tame pasture. Most of the acreage is in native grass and trees.

The soils in this complex have medium to low potential for trees in windbreaks and post lots. Trees will grow in most areas of the Clairemont soil. In some areas, the high water table is a severe limitation. The Woodward soil on side slopes has low potential for trees. The main limitations are steep slopes, depth to bedrock, and the hazard of erosion.

This complex has very low potential for urban and recreation uses. The main limitations are the hazard of flooding and the slopes.

This complex has high potential for the development of habitat for openland wildlife such as rabbits, quail, and red fox. Areas of high terrain, which provide an escape from flood waters for wildlife, are in all mapped areas of this complex. Capability unit VIe-5; Woodward soil is in Loamy Prairie range site, Clairemont soil is in Loamy Bottomland range site.

54—Woodward-Quinlan complex, 1 to 3 percent slopes. This complex consists of small areas of moderately deep and shallow, well drained, very gently sloping soils on ridge crests and hillsides and in drainageways on uplands. The Woodward and Quinlan soils are so intermingled that they could not be separated in mapping at the scale used.

Woodward loam makes up 45 to 55 percent of each mapped area. Typically, the surface layer is reddish brown, calcareous loam about 10 inches thick. The subsoil, which extends to a depth of 32 inches, is yellowish red, calcareous loam that has a few films of soft secondary carbonates. Reddish yellow, weakly cemented, calcareous sandy siltstone is below a depth of 32 inches.

Natural fertility is high, and the organic matter content is medium. Permeability is moderate, and runoff is medium. The root zone is moderately deep.

Quinlan loam makes up 35 to 45 percent of each mapped area. Typically, the surface layer is reddish brown, calcareous loam about 6 inches thick. The subsoil, which extends to a depth of 15 inches, is red, calcareous loam. Light red, weakly cemented, calcareous silty sandstone is below a depth of 15 inches.

Natural fertility and the organic matter content are low. Permeability is moderately rapid. Runoff is rapid. The available water capacity is low, and the root zone is shallow.

Included in mapping are a few areas of Cordell silty clay loam.

The soils in this complex have medium to low potential for cultivated crops. Depth to bedrock and the low available water capacity are the main limitations. These soils are better suited to wheat, a spring crop, than to cotton, a summer crop, because in most years more moisture is available for crops in spring than in summer. These soils are well suited to hay and pasture crops. The management concerns are maintaining soil structure and fertility and controlling erosion. A cropping system that includes crops that produce a large amount of residue that can be returned to the soil and that includes the use of fertilizer, cover crops, and stubble mulch can help to maintain soil structure and fertility and reduce erosion.

These soils have medium to low potential for trees in farmstead windbreaks and post lots. The main limitations are depth to bedrock and the low available water capacity.

These soils have low potential for most urban uses. The main limitation is depth to bedrock, and it is difficult to overcome.

These soils have medium to high potential for most recreation uses. Depth to bedrock is a limitation for recreation facilities, including tennis courts, baseball diamonds, and football fields, that require large, nearly level areas. This limitation can be overcome by a well planned system of land leveling.

These soils have medium to high potential for the development of habitat for openland wildlife such as red fox, rabbits, and quail. They can produce excellent cover but only a fair amount of food. Capability unit IIIe-1; Woodward soil is in Loamy Prairie range site, Quinlan soil is in Shallow Prairie range site.

55—Woodward-Quinlan complex, 3 to 5 percent slopes. This complex consists of small areas of moderately deep and shallow, well drained, gently sloping soils on ridge crests and hillsides and in drainageways on uplands. The Woodward and Quinlan soils are so intermingled that they could not be separated in mapping at the scale used.

Woodward loam makes up 45 to 55 percent of each mapped area. Typically, the surface layer is reddish brown, calcareous loam about 8 inches thick. The subsoil, which extends to a depth of 32 inches, is yellowish red, calcareous loam that has a few films of soft secondary lime. Reddish yellow, weakly cemented, calcareous sandy siltstone is below a depth of 32 inches.

Natural fertility is high, and the organic matter content is medium. Permeability is moderate, and runoff is medium. The root zone is moderately deep.

Quinlan loam makes up 30 to 40 percent of each mapped area. Typically, the surface layer is reddish brown, calcareous loam about 6 inches thick. The subsoil, which extends to a depth of 15 inches, is red, calcareous loam. Light red, weakly cemented silty sandstone is below a depth of 15 inches.

Natural fertility and the organic matter content are low. Permeability is moderately rapid, and runoff is rapid. The available water capacity is low. The root zone is shallow.

Included in mapping are a few small areas of Cordell silty clay loam and a few small sandstone outcrops.

The soils in this complex have medium to low potential for cultivated crops. Depth to bedrock and the low available water capacity are the main limitations. These soils are better suited to wheat, which is a spring crop, than to cotton, which is a summer crop, because in most years more moisture is available for crops in spring than in summer. These soils are well suited to pasture and hay crops. The management concerns are maintaining soil fertility and structure and controlling erosion. A cropping system that includes crops that produce a large amount of residue that can be returned to the soil and that includes the use of fertilizer, cover crops, and stubble mulch can help to maintain soil structure and fertility and reduce erosion.

These soils have medium to low potential for trees in farmstead windbreaks and post lots. The main limitations are depth to bedrock and the low available water capacity. The shallow Quinlan soils are poorly suited to trees; some trees can make a fair growth on the Woodward soils.

These soils have low potential for most urban uses. The main limitation is depth to bedrock, and it is difficult to overcome.

These soils have medium to high potential for most recreation uses. They have low potential for recreation facilities, including football fields, baseball diamonds, and tennis courts, that require large, nearly level areas. The limitations are depth to bedrock and slope; they can be overcome by a well designed system of land leveling.

These soils have medium to high potential for the development of habitat for openland wildlife such as red fox, rabbit, and quail. They can produce excellent cover but only a fair amount of food. Capability unit IVe-3; Woodward soil is in Loamy Prairie range site, Quinlan soil is in Shallow Prairie range site.

56—Yahola fine sandy loam. This is a deep, well drained, nearly level soil on flood plains that are normally flooded once in 1 to 5 years.

Typically, the combined surface layer and subsurface layer are reddish brown, calcareous fine sandy loam about 11 inches thick. Below that, a layer of reddish yellow, calcareous fine sandy loam that is stratified with thin lenses of reddish brown loam extends to a depth of 72 inches.

Included in mapping are some small areas of Clairemont silt loam.

Natural fertility and the organic matter content are medium. Permeability is moderately rapid. Runoff is slow. The root zone is deep.

This soil has high potential for cotton, wheat, and grain sorghum, even though the organic matter content is only

medium. A cropping system that includes crops that produce a large amount of residue that can be returned to the soil and that includes the use of fertilizer and minimum tillage can help to maintain the organic matter content. This soil has high potential for hay and pasture.

This soil has high potential for trees in windbreaks and post lots.

This soil has low potential for most urban and recreation uses. The main limitation is the hazard of flooding.

This soil has high potential for the development of habitat for openland wildlife such as red fox, rabbits, and quail. Capability unit IIw-1; Loamy Bottomland range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information can help identify areas where bedrock, wetness, or very firm soil horizons can cause difficulty in excavation.

Health officials, highway officials, engineers, and others also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Ted Lehman, agronomist, Soil Conservation Service, assisted in writing this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 460,000 acres in Washita County was used for crops and pasture in 1973, according to the Oklahoma Crop and Livestock Reporting Service. Of this total, 87,000 acres was pasture; 207,000 acres was in wheat; 76,400 acres was in cotton; and 38,300 acres was in sorghum. The remaining acreage was in alfalfa, oats, rye, barley, peanuts, soybeans, corn, and guar.

The soils in Washita County have good potential for increased production of food crops. About 10,000 acres of potentially good cropland currently is rangeland or woodland, and about 15,000 acres is in pasture. Food production could also be increased by extending the latest crop production technology to all cropland in the county.

The acreage in crops and pasture remains nearly constant from year to year. The acreage of urban land increases by about 200 acres each year.

In Washita County, *soil erosion* is the major hazard on about two-thirds of the land in crops and pasture. Where the slope is more than 2 percent, erosion is a hazard. Binger, Carey, Cordell, Dill, and St. Paul soils, for example, have slopes of 2 to 5 percent.

If the surface layer is lost through erosion, productivity is reduced, and subsoil material is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils, such as Obaro, Pond Creek, and St. Paul soils, that have a clayey or loamy subsoil and to soils, such as Cordell, Cornick, Quinlan, and Vernon soils, that have bedrock that restricts the depth of the root zone. Erosion also reduces productivity on droughty soils such

as Pratt loamy fine sand. In many areas, soil erosion on farmland results in the pollution of streams by sediment. Controlling erosion minimizes this pollution and improves the quality of water for municipal use, for recreation use, and for fish and wildlife.

Preparing a good seedbed and tilling are difficult in areas where the original friable surface layer has eroded away and clayey subsoil material is exposed. These clayey spots are common in areas of the moderately eroded Obaro soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase water infiltration. A cropping system that maintains plant cover for extended periods reduces soil erosion and preserves the productive capacity of the soils. Use of legume and grass forage crops in the cropping system reduces erosion on sloping soils, provides nitrogen to plants, and improves tilth for the crop that follows.

In most areas of sloping Altus, Grandfield, Devol, and Pratt soils, slopes are short and irregular or the soils are sandy. On these soils, a cropping system that provides abundant plant cover or minimum tillage helps to control erosion. Leaving crop residue on the surface, either by minimum tillage or by stubble mulching, helps to increase water infiltration and reduce runoff and erosion. These practices are difficult to use successfully, however, on eroded soils.

Terraces and diversions reduce the length of slopes and thereby reduce runoff and erosion. They are most practical on deep, well drained soils that have regular slopes, such as Carey, Hardeman, and St. Paul soils. Some soils, for example, Cordell, Cornick, Pratt, and Quinlan soils, are less suitable for terraces and diversions because they have irregular slopes, strong slopes, or bedrock at a depth of less than 20 inches.

Contour tillage is a commonly used erosion control practice in Washita County. Those soils, for example, Binger, Carey, Devol, Hardeman, Shellabarger, and Woodward soils, that have smooth, uniform slopes are the best suited to contour tillage.

Wind erosion is a hazard on the sandy Devol and Pratt soils. If the soils are dry and bare of vegetation or surface mulch, strong winds can damage these soils in a few hours. Maintaining plant cover, using surface mulch, or roughening the surface through tillage minimizes wind erosion on these soils. Shrub and tree windbreaks are effective in reducing wind erosion on sandy soils.

Information on erosion control practices for each kind of soil can be obtained in local offices of the Soil Conservation Service.

Soil drainage is the major management need on a small acreage used for crops and pasture. The somewhat poorly drained Retrop soils, which make up about 2,700 acres in Washita County, are naturally so wet that they are not suitable for crop production.

Altus and Grandfield soils have good natural drainage most of the year, but in low areas they tend to pond after rains because surface drainage is inadequate. Ponded areas generally are 1/2 acre to 3 acres in size. Small areas of wetter soils along drainageways and in swales are commonly included in areas of the well drained soils in the Dill-Quinlan complex and the Woodward-Clairemont complex. Artificial drainage is needed on some of these wetter soils.

The design of surface and subsurface drainage systems varies with the kind of soil. A combined surface and subsurface system is needed in most areas of the somewhat poorly drained Retrop soils that are intensively cropped. Drains need to be more closely spaced on slowly permeable soils than on the more permeable soils. Finding adequate outlets for drainage systems is difficult in some areas. Information on drainage design for each kind of soil can be obtained in local offices of the Soil Conservation Service.

Soil fertility of most upland soils in the survey area is medium to high. The soils on flood plains, such as Amber, Clairemont, Port, Reinach, Retrop, and Yahola soils, are neutral to moderately alkaline and have higher natural fertility than most upland soils.

If the soils are medium acid, they need an application of lime to raise their pH sufficiently for plants that grow well only on slightly acid or neutral soils. The content of available phosphorus and potassium is low on some soils, and fertilizer is needed. On all soils, the amount of lime and fertilizer used should be based on the results of soil tests, on the needs of the crop, and on the expected yield. The Cooperative Extension Service can help to determine the kind and amount of fertilizer and lime to apply.

Soil tilth is important in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Most of the soils used for crops in the survey area have a loamy surface layer that is dark in color and high in content of organic matter. These soils have weak to moderate structure. Intensive rainfall causes the surface to crust. The surface is hard when dry and is nearly impervious to water. Because of the hard surface, runoff increases. Regular additions of manure and other organic material help to improve soil structure and reduce crust formation. Leaving crop residue on the surface also helps to prevent crust formation.

Dark colored, clayey soils, for example, Abilene and Dodson soils, have poor tilth in spring because they remain wet for long periods. If they are plowed when wet, the surface layer is cloddy when the soil dries, and a good seedbed is difficult to prepare. Fall plowing generally results in good tilth in spring.

The soils and climate of the survey area are suited to most of the field crops that are commonly grown in the area and to many that are not. The major row crops are cotton and grain sorghum. Corn and, to an increasing extent, soybeans, guar, sunflowers, sugar beets, and potatoes can be grown if economic conditions are favora-

ble. About 1,000 acres in the eastern part of the county is in peanuts. Wheat is the major close-growing crop. Oats, rye, and barley are commonly grown but on a much smaller scale than wheat.

Specialty crops are not commercially grown in the survey area. Okra, strawberries, blackberries, sweet corn, tomatoes, beans, peas, peppers, and other vegetables and small fruits are grown in home gardens. Cantaloupes, watermelons, and grapes are grown in larger areas. Pears, apricots, apples, and peaches are the most important tree fruits grown in the county.

Deep soils that have good natural drainage and that warm up early in spring are well suited to vegetables and small fruits. Such soils include Altus, Binger, Carey, Clairemont, Devol, Dill, Dougherty, Grandfield, Hardeman, Pond Creek, Port, Reinach, Shellabarger, St. Paul, Woodward, and Yahola soils. If these soils are irrigated, higher yields can be expected.

Most of the well drained soils in the survey area are suited to orchards and nursery plants. Soils in low areas where air drainage is poor and frost is frequent generally are poorly suited to early vegetables, small fruits, and orchards.

The latest information and suggestions for growing specialty crops can be obtained in local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production. (There are no class VIII soils in Washita County.)

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability unit is identified in the description of each map unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-3.

Rangeland

Ernest Snook, range conservationist, Soil Conservation Service, helped prepare this section.

About 25 percent of Washita County is rangeland. A significant part of the farm income is derived from livestock, mainly cattle. Cow-calf-steer operations are dominant in the northern part of the county, and cow-calf-steer-yearling operations are prevalent in most of the county. Winter grazing of small grain is common. The average size of ranches is about 375 acres.

On many ranches the forage produced is supplemented by tame pasture crop stubble and small grain. In winter, the native forage can be supplemented with protein concentrate and hay. Creep-feeding of calves and yearlings to increase market weight is practiced on some ranches.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with brush, weeds, and pricklypear. The amount of forage produced may be less than half of that originally produced. Range productivity can be increased by using management practices that are effective for specific kinds of soil and range sites.

In areas that have similar climate and topography, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic vegetation—the grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed

by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In the central and northwestern parts of the county, soils mainly are silty clay loams that are shallow over red shale. These soils support mid, tall, and short grasses. Their potential productivity is low because of the shallow root zone. In much of the southern and eastern parts of the county, the soils are loamy and are shallow to deep over sandstone or siltstone. There are large areas of rolling and steep soils. Wind erosion is a severe hazard in those areas. Potential productivity of these loamy soils is much greater than that of the shallower soils.

The major management concern on most of the rangeland is controlling grazing so that the kinds and amounts of plants that make up the potential plant community can be reestablished. Controlling brush and minimizing water erosion are also important management concerns.

Engineering

Baker Eeds, engineer, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. If pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use and that limitations are minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils that are rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for

this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to wind erosion.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of

each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13, and, for selected soils in Washita County, in tables 16 and 17.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 10 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a

slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, wind erosion, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Jerome Sykora, biologist, Soil Conservation Service, helped prepare this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of

fair means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, sorghum, wheat, oats, barley, millet, cowpeas, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are lovegrass, switchgrass, clover, alfalfa, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, indiangrass, ragweed, goldenrod, beggarweed, pokeweed, partridgepea, native lespedeza, wheatgrass, croton, fescue, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, cottonwood, dogwood, persimmon, sumac, black walnut, blackberry, grape, buckbrush, mulberry, osageorange, and briers. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated good are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine and cedar.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are roughleaf dogwood, skunkbush, buckbrush, sumac, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartreed, wild millet, rushes, sedges, reeds, cordgrass, and cattail.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail rabbit, and woodchuck.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Examples of wildlife attracted to these areas are wild turkey (fig. 4), thrushes, woodpeckers, tree squirrels, red fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Examples of wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Examples of wildlife attracted

to rangeland are white-tailed deer, bobwhite quail, jackrabbit, meadowlark, and lark bunting.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 18. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in the Unified and AASHTO soil classi-

fication systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and in plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems. In table 14, it is expressed as inches of water per inch of soil.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 14. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or wind erosion, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to wind erosion if cultivated. The groups are used to predict the susceptibility of soil to wind erosion and the amount of soil lost as a result of wind erosion. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly

erodible, but crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly imperviious material These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of

excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Physical and chemical analyses of selected soils

The results of physical analysis of several typical pedons of the survey area are given in table 16. The results of chemical analyses of these soils are given in table 17. The data presented are for samples from soil series that are important in the survey area. All samples were collected from carefully selected sites that are typical of the series and discussed in the section "Soil series and morphology." The soil samples were analyzed by Oklahoma State University.

Most determinations, except those for grain-size analysis, were made on soil material smaller than 2 millimeters in diameter. All capacity measurements are reported on an oven-dry basis. The methods that were used in obtaining the data are indicated in the list that follows. The codes, in parentheses, refer to published methods codes.

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all materials less than 75 mm (3B1).
Coarse materials—(2-250 mm fraction) volume estimate of the percentage of all material greater than 2 mm (3B2).
Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).
Organic matter—peroxide digestion (6A3).
Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2), magnesium (6O2), sodium (6P2), potassium (6Q2).
Cation-exchange capacity—ammonium acetate, pH 7.0 (5A1a).
Base saturation—ammonium acetate, pH 7.0 (5C1).
Reaction (pH)—1:1 water dilution (8C1a).
Reaction (pH)—potassium chloride (8C1c).
Total phosphorus—perchloric acid; colorimetry (6S1a).

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 18.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Oklahoma Department of Highways, Materials Division.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-66T); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56); moisture-density, method A (T99-57); shrinkage (D-427).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*4*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Ustifluvents (*Usti*, meaning subhumid climate, plus *fluvent*, the suborder of Entisols that formed in alluvial sediment).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other

orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Ustifluvents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. An example is the Yahola series, a member of the coarse-loamy, mixed (calcareous), thermic family of Typic Ustifluvents.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*3*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. In the last paragraph the soils of the series are compared to similar soils and to nearby soils of other series. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Abilene series

The Abilene series consists of deep, well drained, nearly level soils on smooth uplands. These soils formed under a cover of tall and mid grasses in loamy and clayey sediment. Slopes are 0 to 1 percent.

Typical pedon of Abilene silt loam (fig. 5), in a cultivated field 2,190 feet north and 30 feet west of the southeast corner of sec. 5, T. 10 N., R. 15 W.

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and moderate granular structure; hard, friable; neutral; clear smooth boundary.

B21t—12 to 17 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, friable; thin discontinuous clay films on ped faces; neutral; gradual smooth boundary.

B22t—17 to 37 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; thin continuous clay films on ped faces; moderately alkaline; gradual smooth boundary.

B3ca—37 to 53 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; very hard, firm; 2 percent soft segregated lime or hard calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

C—53 to 80 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; massive; hard, friable; calcareous; moderately alkaline.

The solum is 28 to 60 inches thick. Depth to bedrock is more than 6 feet. The surface layer is slightly acid to neutral, and the B and C horizons are mildly alkaline through moderately alkaline. Soft, powdery lime is at a depth of 30 to 40 inches.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 or 3. The Bt horizon is clay, silty clay loam, or clay loam. The soil material is 35 to 45 percent clay, but the average clay content is more than 40 percent. The Bt horizon has hue of 10YR or 7.5YR and value of 2 through 5. In the upper part it has chroma of less than 3.5, and in the lower part its chroma ranges to 4. The C horizon ranges in texture from loam to clay. It has hue of 10YR or 7.5YR, value of 4 through 6, and chroma of 1 through 4. The colors of the soils in depressional areas generally have low chroma.

Abilene soils are associated with Carey and St. Paul soils. The B2t horizon of Carey and St. Paul soils is less than 35 percent clay in the upper 20 inches.

The B3ca and C horizons of Abilene silt loam have chroma of 1, and the average depth to secondary carbonates is slightly more than that for the Abilene series; otherwise, this soil is similar in morphology, use, behavior, and management to the soils of the Abilene series.

Altus series

The Altus series consists of deep, well drained, moderately permeable soils that formed in loamy or sandy,

calcareous alluvium. These soils are on smooth prairie uplands. Slopes are 0 to 3 percent.

Typical pedon of Altus fine sandy loam, in an area of Altus and Grandfield soils, 0 to 1 percent slopes, in a cultivated field 2,600 feet west and 200 feet south of the northeast corner of sec. 35, T. 10 N., R. 19 W.

Ap—0 to 10 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; hard, very friable; common fine and medium roots; medium acid; clear smooth boundary.

B1—10 to 16 inches; brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine and medium roots; slightly acid; gradual smooth boundary.

B21t—16 to 26 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; few fine distinct dark gray mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; common fine and medium roots; nearly continuous clay films on faces of peds; few fine black concretions; slightly acid; gradual smooth boundary.

B22tb—26 to 36 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few fine faint gray mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine roots; nearly continuous clay films on faces of peds; few fine black concretions; neutral; gradual smooth boundary.

B23tb—36 to 44 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few fine faint brownish yellow and brown mottles; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, firm; common fine roots; nearly continuous clay films on faces of peds; few fine black concretions; neutral; gradual smooth boundary.

B3b—44 to 64 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; common fine and medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine roots; patchy clay films on faces of peds; few fine medium black concretions; few calcium carbonate concretions and a few films of secondary carbonates; calcareous; moderately alkaline; gradual smooth boundary.

Cb—64 to 72 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; many medium distinct strong brown (7.5YR 5/6) mottles; massive; very hard, firm; few fine black concretions; few calcium carbonate concretions and a few films of secondary carbonates; calcareous; moderately alkaline.

The solum is 45 to more than 72 inches thick. In some pedons, grayish and brownish mottles are below a depth of 15 inches. The A horizon is medium acid to neutral. The B1 and B21t horizons are slightly acid to mildly alkaline. The B22t, B23t, B3, and C horizons are neutral through moderately alkaline. Generally there is soft powdery lime between depths of 40 and 60 inches.

The A horizon has hue of 7.5YR and 5YR, value of 3 through 5, and chroma of 2 or 3.

The B1 horizon is fine sandy loam or sandy clay loam. It has hue of 7.5YR or 5YR, value of 3 through 5, and chroma of 2 or 3. The B21t horizon is fine sandy loam, sandy clay loam, clay loam, or loam. It has hue of 5YR through 10YR, value of 3 or 4, and chroma of 2 or 3. The B22tb and B23tb horizons are fine sandy loam, sandy clay loam, or clay loam, and the soil material is 18 to 35 percent clay. These horizons have hue of 5YR through 10YR, value of 3 through 5, and chroma of 2 through 6. The B3b horizon is similar in texture to the B22tb horizon. It has hue of 5YR or 10YR, value of 4 through 6, and chroma of 2 through 6.

The Cb horizon is fine sandy loam, sandy clay loam, clay loam, or loam. It has hue of 5YR through 10YR, value of 4 through 7, and chroma of 2 through 6.

Altus soils are similar to Abilene, Devol, Grandfield, and Shellabarger soils. The Bt horizon of Abilene soils is more than 35 percent clay. Devol soils have a light colored surface layer and have a Bt horizon that is less than 18 percent clay. Grandfield soils do not have a dark colored surface layer. Shellabarger soils have a dark colored surface layer that is less than 20 inches thick.

The Altus soils in this survey area are a taxadjunct to the Altus series. Unlike typical Altus soils, they have gray mottles nearer to the surface and are slightly more acid in the A horizon and the upper part of the B horizon; however, they are similar in behavior, use, and management to the typical Altus soils.

Amber series

The Amber series consists of deep, well drained, moderately permeable soils that formed in material that weathered from calcareous loamy alluvium. The Amber soils are on river escarpments between the first and second bottoms. Slopes are mainly 3 to 8 percent, but in a few small areas they range to 15 percent.

Typical pedon of Amber very fine sandy loam, 3 to 8 percent slopes, in a cultivated field 100 feet north and 200 feet west of the southeast corner of sec. 34, T. 11 N., R. 16 W.

Ap—0 to 8 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak medium granular structure; slightly hard, friable; calcareous; moderately alkaline; clear smooth boundary.

B—8 to 36 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak medium granular structure; slightly hard, friable; calcareous; moderately alkaline; clear wavy boundary.

C1—36 to 42 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; very hard, firm; stratified with thin lenses of silt loam; calcareous; moderately alkaline; clear smooth boundary.

C2—42 to 64 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; massive; hard, friable; few films and soft spots of secondary lime; calcareous; moderately alkaline.

Depth to bedrock is more than 6 feet. The A horizon is neutral to moderately alkaline, and the B and C horizons are mildly alkaline to moderately alkaline. In most pedons, the soil material is calcareous throughout. Depth to secondary lime is more than 40 inches.

The A horizon has hue of 2.5YR through 7.5YR, value of 4 or 5, dry and 3 or 4, moist, and chroma of 2 through 4. If the horizon has chroma of less than 3.5, it is less than 7 inches thick.

The B horizon is very fine sandy loam or silt loam; it is 12 to 18 percent clay. It has hue of 2.5YR or 5YR, value of 5 or 6, dry and 3 or 4, moist, and chroma of 4 through 6.

The C horizon is very fine sandy loam, silt loam, or silty clay loam. The silty clay loam layers, if present, are 6 to 8 inches thick and lie between strata of very fine sandy loam; they only slightly increase the percentage of clay in the horizon. The C horizon is similar to the B horizon in color.

Amber soils are similar to Dill and Woodward soils. Dill soils are underlain by sandstone at a depth between 20 and 40 inches. Woodward soils have secondary carbonates within 36 inches of the surface and are underlain by sandstone at a depth between 20 and 40 inches.

The A horizon of Amber very fine sandy loam is more alkaline than that typical of the soils in the Amber series; otherwise, this soil is similar in morphology, use, behavior, and management.

Binger series

The Binger series consists of moderately deep, well drained, moderately permeable soils that formed in material that weathered from sandstone. These soils are on hillsides and hilltops on uplands. Slopes are 1 to 5 percent.

Typical pedon of Binger fine sandy loam, 1 to 3 percent slopes, in a cultivated field 1,520 feet east and 215 feet south of the northwest corner of sec. 17, T. 8 N., R. 14 W.

Ap—0 to 7 inches; reddish brown (5YR 5/3) fine sandy loam, reddish brown (5YR 4/3) moist; weak fine granular structure; soft, very friable; common fine roots; neutral; abrupt smooth boundary.

B21t—7 to 24 inches; reddish brown (2.5YR 4/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; weak medium and fine subangular blocky structure; very hard, friable; common fine roots; thin patchy clay films on ped faces; neutral; gradual wavy boundary.

B22t—24 to 28 inches; red (2.5YR 4/6) sandy clay loam and brittle sandstone fragments that appear to be laminated, dark red (2.5YR 3/6) moist; weak fine subangular blocky structure; very hard, friable; few fine roots; few thin patchy clay films on ped faces; neutral; diffuse smooth boundary.

Cr—28 to 34 inches; red (2.5YR 4/6) highly weathered, weakly cemented sandstone, dark red (2.5YR 3/6) moist; difficult to auger by hand when dry, easy to auger when moist; few fine roots; neutral.

The solum is 22 to 40 inches thick. It is slightly acid to neutral. The Cr horizon is neutral to mildly alkaline.

The A horizon has hue of 5YR or 7.5YR; value of 4 through 6, dry, and 3 or 4, moist; and chroma of 2 through 4, dry and moist. If the horizon has a moist value of less than 4 it is less than 7 inches thick. The Bt horizon is sandy clay loam or fine sandy loam, and it is 18 to 25 percent clay. It has hue of 5YR of 2.5YR, value of 4 through 6, and chroma of 4 through 6. The C horizon is weakly cemented sandstone. It is friable enough in the upper few inches for plant roots to penetrate. Typically, it has hue of 2.5YR, but the hue ranges to 10R. It has value of 3 through 5 and chroma of 4 through 6.

Binger soils are similar to Dill, Quinlan, Shellabarger, and Pond Creek soils. Binger soils have more clay in the B horizon than Dill fine sandy loam. They are deeper over sandstone than Quinlan soils but are shallower over sandstone than Shellabarger soils. They are redder and have more sand in the B horizon than Pond Creek soils.

Carey series

The Carey series consists of deep, well drained, moderately permeable soils that formed in redbeds that weathered from siltstone and sandstone. These soils are on hillsides and hilltops on uplands. Slopes are 1 to 5 percent.

Typical pedon of Carey silt loam, 1 to 3 percent slopes, in a cultivated field 500 feet north and 500 feet west of the southeast corner of sec. 2, T. 8 N., R. 20 W.

Ap—0 to 6 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.

A1—6 to 10 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; gradual smooth boundary.

B1—10 to 14 inches; dark reddish gray (5YR 4/2) silt loam, dark reddish brown (5YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; neutral; gradual smooth boundary.

B2t—14 to 36 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; compound weak medium prismatic and moderate medium granular structure; slightly hard, friable; many fine roots; common insect casts; thin patchy clay films; neutral; diffuse smooth boundary.

B3—36 to 44 inches; light reddish brown (2.5YR 6/4) clay loam, reddish brown (2.5YR 4/4) moist; weak medium granular structure; slightly hard, friable; few roots; calcareous; moderately alkaline; diffuse smooth boundary.

C—44 to 54 inches; light reddish brown (2.5YR 6/4) loam, reddish brown (2.5YR 4/4) moist; massive; slightly hard, friable; few roots; calcareous; moderately alkaline; diffuse smooth boundary.

Cr—54 to 62 inches; light red (2.5YR 6/6) silty sandstone, red (2.5YR 5/6) moist; easy to hand auger when moist; calcareous; moderately alkaline.

The solum is 40 to more than 60 inches thick. Depth to secondary carbonates is 18 to 36 inches. The surface layer is slightly acid to neutral. The upper part of the subsoil is neutral to mildly alkaline. The lower part of the subsoil and the C horizon are mildly alkaline to moderately alkaline. A Cr horizon of silty sandstone commonly underlies this soil.

The A horizon is silt loam or loam. It has hue of 7.5YR or 5YR, value of 3 through 5, and chroma of 2 or 3.

The B1 horizon is loam, silt loam, clay loam, or silty clay loam. It has hue of 7.5YR or 5YR, value of 3 through 5, and chroma of 2 through 4. The B2t horizon ranges in texture from loam to silty clay loam, and it is 20 to 30 percent clay. It has hue of 5YR or 2.5YR, value of 3 through 5, and chroma of 3 through 6. The B3 and C horizons range in texture from loam to clay loam. They have hue of 5YR or 2.5YR, value of 3 to 6, and chroma of 4 to 6.

The Cr horizon, where present, is silty sandstone or siltstone. It crushes to fine sandy loam, loam, or silt loam. It has hue of 2.5YR or 5YR, value of 3 through 6, and chroma of 4 through 6.

Carey soils are similar to St. Paul, Pond Creek, Obaro, and Woodward soils. They have a thinner dark colored surface layer and have carbonates nearer to the surface than St. Paul and Pond Creek soils. Carey soils also have a darker colored surface layer than Obaro and Woodward soils; carbonates are leached to a greater depth in Carey soils than in those soils.

Clairemont series

The Clairemont series consists of deep, well drained, moderately permeable soils that are forming in loamy, alkaline sediment. They are on nearly level bottom lands that are flooded once in 1 to 5 years.

Typical pedon of Clairemont silt loam, in a cultivated field 600 feet east and 600 feet south of the northwest corner of sec. 12, T. 10 N., R. 16 W.

Ap—0 to 9 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak fine granular structure; hard, friable; common fine roots; calcareous; moderately alkaline; clear smooth boundary.

C1—9 to 28 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak medium granular structure; faint bedding planes; hard, friable; common fine roots; thin lenses of loam and fine sandy loam strata; calcareous; moderately alkaline; gradual smooth boundary.

C2—28 to 44 inches; reddish brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/4) moist; moderate medium granular structure; faint bedding planes; very hard, friable; few fine roots; calcareous; moderately alkaline; clear smooth boundary.

C3—44 to 62 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; massive; hard, friable; few fine roots; stratified with thin lenses of fine sandy loam; calcareous; moderately alkaline.

Typically, the soil material is calcareous and moderately alkaline throughout, but in a few pedons it is leached to a depth of 12 inches. The water table is at a depth of more than 10 feet.

The A horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 through 6. The C horizon is silt loam or silty clay loam, and it is 18 to 35 percent clay. Thin strata of other textures are also present. The C horizon has hue of 5YR through 2.5YR, value of 4 through 6, and chroma of 4 through 6. In some pedons there is a buried A horizon below a depth of 36 inches.

Clairemont soils are similar to Port, Yahola, and Reinach soils. They have a lighter colored surface layer than Port soils. In Port soils, lime has been leached to a greater depth. Yahola soils are sandier than Clairemont soils. Reinach soils have a thicker and darker colored surface layer than Clairemont soils; in Reinach soils, lime has been leached to a greater depth.

Cordell series

The Cordell series consists of shallow, somewhat excessively drained, moderately permeable soils that formed in material that weathered from hard siltstone under a cover of mid and short grasses. These soils are on hilltops and hillsides and in swales and canyons on uplands. Slopes are 1 to 15 percent.

Typical pedon of Cordell silty clay loam (fig. 6), in an area of Cordell-Rock outcrop complex, 2 to 15 percent slopes, in native rangeland 800 feet east and 100 feet north of the southwest corner of sec. 2, T. 11 N., R. 18 W.

A1—0 to 6 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium granular structure; slightly hard, friable; many roots; 1 percent, by volume, fragments of silt-

stone less than 1 inch in diameter; calcareous; moderately alkaline; clear smooth boundary.

B21—6 to 10 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate medium granular structure; hard, friable; common roots; 5 percent, by volume, fragments of siltstone less than 1 inch in diameter; calcareous; moderately alkaline; gradual wavy boundary.

B22—10 to 14 inches; red (2.5YR 5/6) very shaly silty clay loam, red (2.5YR 4/6) moist; weak medium granular structure; hard, friable; few roots; 75 percent, by volume, fragments of siltstone 1/4 to 1 inch in diameter; films of secondary carbonates; calcareous; moderately alkaline; clear wavy boundary.

R—14 to 17 inches; red (2.5YR 5/6) hard siltstone, red (2.5YR 4/6) moist; calcareous; moderately alkaline.

The thickness of the solum and the depth to bedrock range from 10 to 20 inches. The soil material is moderately alkaline to mildly alkaline throughout. The A horizon is 0 to 10 percent, by volume, coarse siltstone fragments that are less than 3 inches in diameter; the upper part of the B horizon is 0 to 30 percent coarse fragments; and the lower part of the B horizon is 50 to 75 percent.

The A horizon is silty clay loam or silt loam. It has hue of 2.5YR or 5YR, value of 4 and 5, and chroma of 4 through 6. The upper part of the B horizon is silty clay loam, silt loam, shaly silty clay loam, or shaly silt loam. The lower part of the B horizon is very shaly silty clay loam or very shaly silt loam. The colors of the B horizon are the same as those of the A horizon. The R layer is hard siltstone. It has hue of 2.5YR or 10R, value of 4 or 5, and chroma of 4 through 6.

Cordell soils are similar to Cornick, Quinlan, and Vernon soils. Cornick soils are 5 to 10 inches thick over gypsum bedrock. Quinlan soils are 10 to 20 inches thick over weakly cemented, calcareous sandstone. Vernon soils are deeper and more clayey than Cordell soils.

Cornick series

The Cornick series consists of very shallow, well drained, moderately permeable soils that formed in material that weathered from impure gypsum under a cover of mid and short grasses. These soils are on hilltops, hillsides, and along canyons on uplands. Slopes are mainly 1 to 12 percent, but in areas near canyon escarpments they range to 50 percent.

Typical pedon of Cornick silt loam, in an area of Cornick-Rock outcrop complex, 1 to 12 percent slopes, in native grassland on the crest of a hill, 200 feet south and 50 feet east of the northwest corner of sec. 12, T. 9 N., R. 14 W.

A1—0 to 7 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many roots; calcareous; moderately alkaline; abrupt wavy boundary.

Cr—7 to 11 inches; white (5YR 8/1) gypsum that has a few streaks and bodies of pink (5YR 7/3); massive; mass is noncalcareous; seams are calcareous.

The thickness of the solum and the depth to bedrock range from 5 to 10 inches. The A horizon and the upper part of the C horizon are moderately alkaline; typically, they are calcareous, but in some pedons they are noncalcareous. The lower part of the C horizon is noncalcareous, but in some pedons it has bodies of lime in seams and fractures.

The A horizon is silt loam or loam. It has hue of 7.5YR or 10YR, value of 3 through 5, and chroma of 2 or 3. A C1 horizon of weathered gypsum is in some pedons. The Cr horizon is gypsum of paralithic hardness. It has hue of 7.5YR or 5YR, value of 8, and chroma of 1 through 4.

Cornick soils are similar to Cordell, Quinlan, and Vernon soils. Cordell soils have hard siltstone at a depth of 10 to 20 inches. Quinlan soils have weakly cemented, calcareous sandstone at a depth of 10 to 20 inches. Vernon soils formed in clayey redbeds and are deeper than Cornick soils.

Devol series

The Devol series consists of deep, well drained soils that formed in sandy eolian deposits or alluvial sediment reworked by the wind. These soils are on uplands that originally were covered with tall grasses. Slopes are complex and range from 0 to 8 percent. Relief is undulating to hummocky.

Typical pedon of Devol loamy fine sand, in an area of Devol-Grandfield complex, 3 to 8 percent slopes, in a cultivated field 1,975 feet south and 270 feet east of the northwest corner of sec. 14, T. 9 N., R. 19 W.

Ap—0 to 8 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

A1—8 to 16 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; weak fine granular structure; soft, very friable; neutral; gradual smooth boundary.

B2t—16 to 28 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; moderate fine and medium granular structure; soft, very friable; clay films between sand grains; neutral; diffuse smooth boundary.

B3—28 to 46 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak medium granular structure; soft, very friable; neutral; diffuse smooth boundary.

C—46 to 72 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; massive; loose, very friable; neutral.

The solum is 30 to 60 inches thick. The A horizon is slightly acid to mildly alkaline. The Bt and B3 horizons are neutral through moderately alkaline and are noncalcareous. The C horizon is neutral through moderately alkaline. In some pedons, the soil material below a depth of 36 inches is calcareous.

The A horizon has hue of 5YR or 2.5YR, value of 3 through 5, and chroma of 4 through 6. The Bt horizon is fine sandy loam that is 8 to 18 percent clay. The Bt, B3, and C horizons have hue of 5YR or 2.5YR and value and chroma of 4 through 6. The B3 horizon is fine sandy loam or loamy fine sand. The C horizon is fine sandy loam or loamy sand. In some pedons, red weathered sandstone is at a depth of more than 60 inches.

Devol soils are similar to Binger, Grandfield, and Pratt soils. Binger and Grandfield soils have a subsoil that is more than 18 percent clay, and Binger soils have sandstone within a depth of 40 inches. Pratt soils have a loamy fine sand subsoil.

Dill series

The Dill series consists of moderately deep, well drained soils that have moderately rapid permeability. These soils formed in material that weathered from weakly cemented sandstone under a cover of mid and tall grasses. They are on broad flats, in swales, on hillsides and hilltops, and along drainageways on uplands. Slopes range from 0 to 12 percent.

Typical pedon of Dill fine sandy loam, 1 to 3 percent slopes, in rangeland 4,000 feet west and 600 feet south of the northeast corner of sec. 21, T. 11 N., R. 19 W.

A1—0 to 14 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; hard, very friable; many fine roots; common worm casts; neutral; gradual smooth boundary.

B21—14 to 21 inches; reddish brown (2.5YR 4/4) fine sandy loam, dark reddish brown (2.5YR 3/4) moist; weak medium prismatic structure parting to weak fine granular; hard, very friable; many roots; common worm casts; few krotovinas; neutral; gradual smooth boundary.

B22—21 to 33 inches; reddish brown (2.5YR 4/4) fine sandy loam, dark reddish brown (2.5YR 3/4) moist; weak medium prismatic structure parting to weak fine granular; hard, very friable; many roots; common worm casts; few krotovinas; few fragments of soft sandstone; neutral; clear wavy boundary.

Cr—33 to 47 inches; red (10R 5/6) weakly cemented noncalcareous sandstone, red (10R 4/6) moist; thin bands of dark red (2.5YR 3/6) calcareous sandstone.

The thickness of the solum and the depth to sandstone range from 20 to 40 inches. The A and B horizons are slightly acid to mildly alkaline. The C horizon is slightly acid to moderately alkaline and is noncalcareous. In some pedons, seams or nodules of calcium carbonate are in fracture joints and crevices of the sandstone.

The A horizon typically is fine sandy loam but is loamy fine sand in a few winnowed areas. It has hue of 5YR or 2.5YR, value of 3 through 5, and chroma of 3 or 4. The content of organic carbon is less than 0.06 percent where the horizon has chroma of 3. The B horizon is fine sandy loam that is 10 to 18 percent clay. It has hue of 2.5YR or 10R, value of 4 or 5, and chroma of 4 through 6. The Cr horizon is weakly cemented sandstone. It has hue of 2.5YR and 10R, value of 4 and 5, and chroma of 4 through 8.

Dill soils are similar to Binger, Grandfield, Shellabarger, and Hardeman soils. Binger, Grandfield, and Shellabarger soils have a better developed B horizon. Grandfield and Shellabarger soils do not have sandstone within a depth of 40 inches. Hardeman soils are more alkaline and do not have sandstone within a depth of 40 inches.

Dodson series

The Dodson series consists of nearly level, deep, well drained soils that have moderately slow permeability. These soils formed in material that weathered from silty and clayey sediment under a cover of mid and tall grasses. They are on upland terraces. Slopes are 0 to 1 percent.

Typical pedon of Dodson silt loam, 0 to 1 percent slopes, in a cultivated field 2,500 feet west and 100 feet north of the southeast corner of sec. 17, T. 8 N., R. 17 W.

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; neutral; clear smooth boundary.

A1—12 to 19 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; hard, friable; mildly alkaline; clear smooth boundary.

B21t—19 to 31 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; very hard, friable; patchy clay films on faces of peds; noncalcareous; mildly alkaline; clear smooth boundary.

B22t—31 to 40 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; continuous clay films on faces of peds; noncalcareous; mildly alkaline; gradual smooth boundary.

B23t—40 to 70 inches; brown (7.5YR 5/2) silty clay, brown (7.5YR 4/2) moist; moderate medium subangular blocky structure; hard, friable; patchy clay films on faces of peds; few fine soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—70 to 80 inches; brown (7.5YR 5/2) silty clay loam, brown (7.5YR 4/2) moist; massive; very hard, firm; about 40 percent reddish brown (5YR 5/4) silty clay loam; about 5 percent fine soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 50 to more than 72 inches thick. The depth to secondary carbonates is 32 to 48 inches. The A horizon and the upper part of the Bt horizon are neutral or mildly alkaline. The lower part of the Bt horizon and the C horizon are moderately alkaline and calcareous. They have less than 10 percent calcium carbonate equivalent.

The A horizon has hue of 10YR or 7.5YR, value of 3 through 5, and chroma of 2 or 3. The B21t horizon is silty clay loam or silty clay. It has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The B22t and B23t horizons are silty clay loam or silty clay and are 35 to 45 percent clay. They have hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 2 or 3. The C horizon is silt loam, clay loam, silty clay loam, or silty clay. It has hue of 7.5YR and 5YR, value of 3 through 5, and chroma of 2 through 4.

Dodson soils are similar to Abilene, Pond Creek, and St. Paul soils. Abilene soils have secondary lime nearer to the surface than Dodson soils. Pond Creek and St. Paul soils are less than 35 percent clay in the upper 20 inches of the Bt horizon.

Dougherty series

The Dougherty series consists of deep, well drained, moderately permeable soils that formed in material that weathered from sandy sediment. These soils are on hilltops and hillsides and in swales on uplands that were originally covered with blackjack trees. Slopes are smooth to complex and range from 3 to 8 percent.

Typical pedon of Dougherty loamy fine sand, in an area of Dougherty-Eufaula complex, 3 to 8 percent slopes, in native rangeland 500 feet west and 50 feet north of the southeast corner of sec. 24, T. 10 N., R. 14 W.

A1—0 to 6 inches; brown (7.5YR 5/2) loamy fine sand, brown (7.5YR 4/2) moist; weak fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

A2—6 to 26 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; massive; soft, very friable; slightly acid; gradual wavy boundary.

B2t—26 to 42 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable; clay films on ped faces and bridging sand grains; slightly acid; diffuse smooth boundary.

B3—42 to 51 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; weak medium granular structure; slightly hard, friable; slightly acid; diffuse smooth boundary.

C—51 to 72 inches; light red (2.5YR 6/6) loamy fine sand, red (2.5YR 5/6) moist; massive; soft, very friable; medium acid.

The solum is 45 to more than 72 inches thick. The A horizon is 20 to 40 inches thick. The soil material is slightly acid to strongly acid throughout.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 through 7, and chroma of 2 through 4. The A2 horizon is loamy fine sand or fine sand. It has hue of 7.5YR or 10YR, value of 5 through 7, and chroma of 2 through 4.

The B2t horizon ranges from sandy clay loam to fine sandy loam and is 18 to 32 percent clay. It has hue of 2.5YR or 5YR, value of 4 and 5, and chroma of 4 through 6. The B3 horizon ranges from sandy clay loam to fine sandy loam. It has hue of 2.5YR or 5YR and value and chroma of 4 through 6.

The C horizon ranges in texture from loamy fine sand to fine sandy loam. It has hue of 2.5YR or 5YR, value of 5 through 7, and chroma of 4 through 8.

Dougherty soils are similar to Binger, Eufaula, Grandfield, and Devol soils. Binger, Grandfield, and Devol soils have an A horizon that is less than 20 inches thick, and they do not have an A2 horizon. In addition, Binger soils have sandstone between depths of 20 and 40 inches, and Devol soils are less than 18 percent clay. Eufaula soils have an A horizon that is more than 40 inches thick; they do not have an argillic horizon within a depth of 40 inches.

Eufaula series

The Eufaula series consists of deep, somewhat excessively drained, rapidly permeable soils that formed in sandy material of eolian origin. The topography is undulating to hummocky. Slopes are 3 to 8 percent. The original vegetation was blackjack oak with an understory of tall grasses.

Typical pedon of Eufaula loamy fine sand, in an area of Dougherty-Eufaula complex, 3 to 8 percent slopes, in native rangeland 600 feet west and 100 feet north of the southeast corner of sec. 24, T. 10 N., R. 14 W.

A1—0 to 8 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; single grained; loose when moist and when dry; slightly acid; gradual smooth boundary.

A21—8 to 40 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose when moist and when dry; slightly acid; clear wavy boundary.

A22&B2t—40 to 72 inches; yellowish red (5YR 5/6) fine sand, yellowish red (5YR 4/6) moist; (A22); single grained; massive lamellae of reddish brown (5YR 5/4) loamy fine sand (B2t); slightly hard, friable; lamel-

lae are 3/8 to 1 inch thick and 2 to 4 inches apart; they have clay bridges between the sand grains.

The solum is 72 to more than 120 inches thick. The A1 or Ap horizon is loamy fine sand or fine sand. It has hue of 10YR or 7.5YR, value of 4 through 7, and chroma of 3 through 4. It is slightly acid or medium acid. The A2 horizon is loamy fine sand or fine sand. It has hue of 7.5YR or 10YR, value of 6 through 8, and chroma of 3 or 4.

It is strongly acid to neutral. The B2t horizon consists of lamellae of loamy fine sand that are 1/8 to 1 inch thick. It has hue of 2.5YR through 7.5YR, value of 4 through 6, and chroma 4 through 8. It is slightly acid through strongly acid.

Eufaula soils are similar to Devol and Dougherty soils. Devol soils have an A horizon that is less than 20 inches thick, and Dougherty soils have an A horizon that is 20 to 40 inches thick. Dougherty soils have a Bt horizon that is more than 18 percent clay.

Grandfield series

The Grandfield series consists of deep, well drained, moderately permeable soils that formed in loamy alluvial or eolian deposits under a cover of mid and tall grasses. These soils are in broad areas on uplands. Slopes are single to complex and range from 0 to 5 percent.

Typical pedon of Grandfield fine sandy loam, 1 to 3 percent slopes, in a cultivated field 3,000 feet north and 100 feet west of the southeast corner of sec. 33, T. 10 N., R. 18 W.

A1—0 to 10 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak medium granular structure; soft, very friable; neutral; gradual smooth boundary.

B1—10 to 18 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; moderate medium granular structure; slightly hard, friable; neutral; gradual smooth boundary.

B2t—18 to 36 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; thin patchy clay films on ped faces; mildly alkaline; gradual smooth boundary.

B3—36 to 56 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; gradual smooth boundary.

C—56 to 72 inches; red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; massive; slightly hard, very friable; mildly alkaline.

The solum is 50 to more than 72 inches thick. The upper part of the solum is slightly acid to mildly alkaline, and the lower part is neutral to moderately alkaline. The C horizon is mildly alkaline to moderately alkaline and is calcareous.

The A horizon typically is fine sandy loam but ranges to loamy fine sand. It has hue of 5YR or 7.5YR, value of 3 through 5, and chroma of 2 through 4. The organic matter content is less than one percent. The B1 horizon, where present, and the B2t horizon range from sandy clay loam to loam and are 18 to 30 percent clay. They have hue of 5YR and 2.5YR, value of 3 through 5, and chroma of 3 through 6. The B3 and C horizons range from fine sandy loam to sandy clay loam. They have hue of 2.5YR or 5YR, value of 4 through 6, and chroma of 4 through 8.

Grandfield soils are similar to Binger and Shellabarger soils. Binger soils have sandstone between depths of 20 and 40 inches. Shellabarger soils have a dark colored surface layer that has an organic matter content of more than one percent.

Hardeman series

The Hardeman series consists of deep, well drained soils that have moderately rapid permeability. These soils formed in material that weathered from eolian deposits under a cover of mid and tall grasses. They are on hilltops and hillsides and in swales on uplands. Slopes are 1 to 8 percent.

Typical pedon of Hardeman fine sandy loam, 3 to 5 percent slopes, in a cultivated field 300 feet east and 100 feet south of the northwest corner of sec. 4, T. 10 N., R. 14 W.

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A1—7 to 14 inches; brown (7.5YR 5/4) fine sandy loam, brown (7.5YR 4/4) moist; moderate medium granular structure; slightly hard, very friable; neutral; gradual smooth boundary.

B21—14 to 30 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; moderate fine granular structure; slightly hard, very friable; mildly alkaline; gradual smooth boundary.

B22—30 to 50 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; gradual smooth boundary.

C—50 to 72 inches; reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The solum is 25 to 60 inches thick. Bedrock is at a depth of more than 6 feet. The A horizon is slightly acid to mildly alkaline, and the B and C horizons are neutral to moderately alkaline. In some pedons, the B and C horizons are calcareous. In about 50 percent of the

pedons, carbonates are between depths of 24 and 50 inches.

The A horizon is fine sandy loam, very fine sandy loam, or loam. It has hue of 7.5YR or 5YR, value of 4 through 6, and chroma of 3 or 4. The B horizon is fine sandy loam or loam that is 12 to 18 percent clay. It has hue of 7.5YR to 2.5YR, value of 4 through 6, and chroma of 4 through 6. The C horizon has the same textures as the B horizon. It has hue of 5YR and 2.5YR, and value and chroma of 4 through 6.

Hardeman soils are similar to Dill and Woodward soils. Dill soils are noncalcareous and have sandstone between depths of 20 and 40 inches. Woodward soils are calcareous throughout, and they have a siltier control section than Hardeman soils.

Obaro series

The Obaro series consists of moderately deep, well drained soils that formed in calcareous material that weathered from silty redbeds under a cover of mid and short grasses. These soils are on smooth uplands. Slopes are mainly 1 to 5 percent, but on some hillsides they range to 7 percent.

Typical pedon of Obaro silty clay loam, 1 to 3 percent slopes, in a cultivated field 2,500 feet north and 50 feet east of the southwest corner of sec. 23, T. 11 N., R. 17 W.

Ap—0 to 8 inches; reddish brown (2.5YR 4/4) silty clay loam, dark reddish brown (2.5YR 3/4) moist; weak fine granular structure; slightly hard, friable; calcareous; moderately alkaline; clear smooth boundary.

B2—8 to 26 inches; red (2.5YR 4/6) silty clay loam, dark red (2.5YR 3/6) moist; moderate fine and medium granular structure; hard, firm; few soft bodies and a few concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—26 to 38 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate medium granular structure; hard, firm; 15 percent soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cr—38 to 40 inches; red (2.5YR 4/6) consolidated redbed shale; very hard, firm; calcareous; moderately alkaline.

The solum is 24 to 40 inches thick. Depth to a distinct accumulation of calcium carbonate is between 12 and 30 inches.

The A horizon is loam, silt loam, clay loam, or silty clay loam. It has hue of 7.5YR to 2.5YR and value and chroma of 3 through 6. Where this horizon has value and chroma of less than 3.5, moist, it is less than 7 inches thick. The B horizon is loam, clay loam, or silty clay loam and is 20 to 35 percent clay. The content of calcium carbonate ranges from 0 to 5 percent in the B2 horizon and from 5 to 25 percent in the B3ca horizon. The B horizon has hue of 5YR or 2.5YR and value and chroma of 4 through 6. The Cr horizon is weakly cemented sandstone or stratified siltstone and shale. It has hue of 5YR or 2.5YR and value and chroma of 4 through 6.

Obaro soils are similar to Vernon and Woodward soils. The subsoil of Obaro soils is less clayey than that of Vernon soils, and it is more clayey than that of Woodward soils.

Pond Creek series

The Pond Creek series consists of deep, well drained soils that have moderately slow permeability. These soils formed in material that weathered from loamy alluvium or redbed residuum under a cover of mid and tall grasses. They are on broad flats. Slopes are 0 to 3 percent.

Typical pedon of Pond Creek fine sandy loam, 0 to 1 percent slopes, in a cultivated field about 1,600 feet east and 1,700 feet north of the southwest corner of sec. 14, T. 10 N., R. 14 W.

Ap—0 to 10 inches; brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; soft, very friable; common roots; neutral; abrupt smooth boundary.

B21t—10 to 28 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak medium prismatic structure and weak medium subangular blocky; hard, firm; common roots and insect casts; thin patchy clay films; neutral; gradual smooth boundary.

B22t—28 to 41 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate coarse prismatic structure and moderate medium subangular blocky; very hard, very firm; few roots; few insect casts; thick continuous clay films; mildly alkaline; gradual smooth boundary.

B23t—41 to 60 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; weak medium prismatic structure and weak fine granular; hard, firm; mildly alkaline; gradual smooth boundary.

B3—60 to 78 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; weak medium granular structure; hard, friable; mildly alkaline.

The solum is 40 to more than 60 inches thick. The depth to secondary lime is 45 to more than 60 inches. The A, B21t, and B22t horizons are slightly acid to mildly alkaline. The B23t horizon is neutral to moderately alkaline, and the B3 horizon is mildly alkaline or moderately alkaline.

The A horizon has hue of 7.5YR or 5YR, value of 3 and 5, and chroma of 2 or 3. The B21t and B22t horizons are silt loam or silty clay loam that is 24 to 35 percent clay. They have hue of 7.5YR or 5YR, value of 3 through 5, and chroma of 2 or 3. Below a depth of 20 inches, they have chroma of 4. The B23t horizon is loam, silt loam, clay loam, or silty clay loam. It has hue

of 7.5YR through 2.5YR, value of 4 and 5, and chroma of 3 through 6. The B3 horizon is similar in texture to the B23t horizon. It has hue of 7.5YR through 2.5YR, value of 4 and 5, and chroma of 3 through 8.

Pond Creek soils are similar to Abilene, Shellabarger, and St. Paul soils. Pond Creek soils have a less clayey subsoil and have lime leached to a greater depth than Abilene soils. They have a thicker dark colored surface layer and a less sandy subsoil than Shellabarger soils. They have secondary lime leached to a greater depth than St. Paul soils.

Port series

The Port series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in material that weathered from loamy sediment under a cover of native grasses and a few hardwood trees. Slopes are 0 to 1 percent.

Typical pedon of Port silt loam, in a cultivated field about 2,200 feet north and 100 feet west of the southeast corner of sec. 4, T. 10 N., R. 17 W.

Ap—0 to 10 inches; brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many roots; neutral; abrupt smooth boundary.

A1—10 to 22 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium granular structure; hard, friable; many roots; mildly alkaline; diffuse wavy boundary.

B2—22 to 40 inches; reddish brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) moist; weak medium subangular blocky structure; very hard, friable; common roots; common worm casts; few soft bodies of calcium carbonate below a depth of 32 inches; calcareous; moderately alkaline; gradual wavy boundary.

C—40 to 60 inches; reddish brown (2.5YR 4/4) silt loam, dark reddish brown (2.5YR 3/4) moist; massive; hard, friable; few roots; many soft bodies of calcium carbonate; calcareous; moderately alkaline.

The A horizon is 20 to 40 inches thick. The depth to secondary carbonates is 20 to 60 inches. The A horizon is slightly acid to mildly alkaline; the B horizon is slightly acid to moderately alkaline; and the C horizon is moderately alkaline and calcareous.

The A horizon is loam, silt loam, or silty clay loam. It has hue of 7.5YR and 5YR, value of 3 through 5, and chroma of 2 or 3. The B horizon is loam, silt loam, clay loam, or silty clay loam, and it is 18 to 35 percent clay between depths of 10 and 40 inches. It has hue of 7.5YR to 2.5YR, value of 3 through 5, and chroma of 2 and 3. Below a depth of 20 inches, the chroma ranges to 6. The C horizon is similar in texture to the B horizon, but in some strata the soil material is coarser or finer textured. Color is the same as that of the B horizon below a depth of 20 inches.

Port soils are similar to Clairemont, Reinach, and Yahola soils. Clairemont and Yahola soils have a lighter colored surface layer and are calcareous. Reinach soils have a less clayey subsoil than Port soils.

Pratt series

The Pratt series consists of deep, well drained, rapidly permeable soils that formed in sandy eolian deposits under a cover of mid and tall grasses. These soils are in undulating to hummocky areas, and slopes are mainly 5 to 12 percent.

Typical pedon of Pratt loamy fine sand, 5 to 12 percent slopes, 900 feet east and 70 feet south of the northwest corner of sec. 22, T. 9 N., R. 19 W.

A1—0 to 10 inches; reddish brown (5YR 4/4) loamy fine sand, dark reddish brown (5YR 3/4) moist; weak fine granular structure; soft, very friable; slightly acid; gradual smooth boundary.

B2t—10 to 18 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; weak medium granular structure; soft, very friable; sand grains coated with thin clay films; neutral; gradual smooth boundary.

C—18 to 72 inches; yellowish red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) moist; single grained; loose; neutral.

The solum is 10 to 50 inches thick. The A and Bt horizons are slightly acid to neutral. The C horizon is neutral to mildly alkaline. In a few pedons the soil material is moderately alkaline below a depth of 40 inches.

The A horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 through 6. Where the horizon has chroma of 3, the organic matter content is less than one percent. The Bt horizon is loamy fine sand, and it is at least 3 percent higher in clay content than the A horizon. It has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 through 6. The C horizon is loamy fine sand to a depth of 40 inches, but in some pedons it is fine sand below a depth of 40 inches. Its color is the same as that of the Bt horizon.

Pratt soils are similar to Devol and Dougherty soils. Devol and Dougherty soils have more clay in the B horizon than Pratt soils.

Pratt soils in this county have a surface layer that has hue of 5YR, which is outside the range for the Pratt series. Otherwise, these soils are similar in behavior, use, and management to the soils of the Pratt series.

Quinlan series

The Quinlan series consists of shallow, well drained soils on uplands. These soils are on ridgetops and hillsides, in swales, and along canyons. They formed in

calcareous or alkaline, weakly consolidated sandstone under a cover of mid and short grasses (fig. 7). Permeability is moderately rapid. Slopes are single to complex and are mainly 2 to 12 percent, but they range to 45 percent on canyon escarpments.

Typical pedon of Quinlan loam, in an area of Quinlan-Woodward complex, 5 to 12 percent slopes, in native rangeland about 350 feet west and 50 feet north of the southeast corner of sec. 25, T. 9 N., R. 17 W.

A—0 to 6 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, friable; calcareous; moderately alkaline; gradual wavy boundary.

B2—6 to 19 inches; red (2.5YR 4/6) loam, dark red (2.5YR 3/6) moist; moderate medium granular structure; slightly hard, friable; calcareous; moderately alkaline; clear smooth boundary.

Cr—19 to 24 inches; light red (2.5YR 6/6) sandy siltstone, red (2.5YR 5/6) moist; weakly cemented; calcareous.

The solum is 10 to 20 inches thick. Typically, the soil material is calcareous throughout, but in some pedons it is alkaline and noncalcareous.

The A horizon is loam, silt loam, or fine sandy loam. It has hue of 7.5YR to 2.5YR, value of 4 through 6, and chroma of 4 through 6. The B horizon is loam or silt loam that is 10 to 27 percent clay. Colors are the same as those for the A horizon. The Cr horizon ranges from weakly consolidated sandstone to sandy siltstone.

Quinlan soils are similar to Cordell, Cornick, Woodward, and Vernon soils. Cordell soils formed in hard siltstone. Cornick soils have gypsum at a depth between 5 and 10 inches. Woodward soils do not have sandstone within a depth of 20 inches. Vernon soils are deeper and have more clay than Quinlan soils, and they formed in clay and shale material.

Reinach series

The Reinach series consists of deep, well drained, moderately permeable soils that formed in calcareous loamy alluvium under a cover of tall native grasses and scattered hardwood trees. These soils are on low stream terraces. Slopes are 0 to 1 percent.

Typical pedon of Reinach silt loam, in a cultivated field about 2,600 feet east and 150 feet north of the southwest corner of sec. 26, T. 11 N., R. 16 W.

Ap—0 to 8 inches; brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; many roots; neutral; gradual smooth boundary.

A1—8 to 29 inches; reddish gray (5YR 5/2) silt loam, dark reddish brown (5YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; many roots; many worm casts; neutral; gradual smooth boundary.

B2—29 to 39 inches; reddish brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/4) moist; weak fine and medium granular structure; slightly hard, very friable; many roots; many worm casts; calcareous; mildly alkaline; gradual smooth boundary.

C—39 to 74 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; massive; slightly hard, very friable; many roots; many worm casts; few soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

The solum is 20 to 48 inches thick. The depth to soft powdery lime is 28 to 48 inches. The A horizon is slightly acid to mildly alkaline. The B2 horizon, where present, is neutral to moderately alkaline. The C horizon is mildly alkaline to moderately alkaline, and it is calcareous.

The A horizon is fine sandy loam or silt loam. It has hue of 7.5YR and 5YR, value of 3 through 5, and chroma of 2 or 3. The B2 horizon, where present, and the upper part of the C horizon are very fine sandy loam or silt loam that is 10 to 18 percent clay. They have hue of 7.5YR to 2.5YR, value of 3 through 5, and chroma of 3 or 4 to a depth of 40 inches. The lower part of the C horizon, below a depth of 40 inches, ranges from fine sandy loam to silty clay loam. It has hue of 5YR or 2.5YR, value of 3 through 7, and chroma of 4 through 6.

Reinach soils are similar to Hardeman, Port, and Yahola soils. Unlike Reinach soils, Hardeman soils have a light colored surface layer, and Port soils are more than 18 percent clay between depths of 10 and 40 inches. Yahola soils have a lighter colored surface layer and are sandier than Reinach soils.

Retrop series

The Retrop series consists of deep, somewhat poorly drained soils on nearly level flood plains of tributary streams throughout the county. These soils formed in calcareous silty sediment. They are flooded frequently; the water table fluctuates but generally is within a depth of 2 1/2 to 4 feet. The recent clogging of well defined channels has caused the water table to rise.

Typical pedon of Retrop silty clay loam, in a bermudagrass pasture 450 feet east and 100 feet north of the southwest corner of sec. 25, T. 9 N., R. 17 W.

A1—0 to 7 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak medium granular structure; hard, friable; calcareous; moderately alkaline; gradual smooth boundary.

C1—7 to 30 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; massive; hard, friable; calcareous; moderately alkaline; diffuse smooth boundary.

C2—30 to 64 inches; reddish brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; massive

with a few thin bedding planes; hard, friable; calcareous; moderately alkaline.

The A horizon has hue of 5YR; value of 4 or 5, dry; and chroma of 3 or 4. Where the surface layer has chroma of less than 3.5, it is less than 7 inches thick. The C horizon is loam or silty clay loam. The 10- to 40-inch control section is 18 to 35 percent clay, but there are thin strata of variable texture. Throughout the C horizon, the soil has hue of 5YR; value of 4 or 5, dry, and 3 or 4, moist; and chroma of 3 or 4. In some pedons, there are buried horizons below a depth of 24 inches.

Shellabarger series

The Shellabarger series consists of deep, well drained, moderately permeable soils that formed in loamy alluvium under a cover of tall grasses. These soils are on upland benches, hillsides, and hilltops. Slopes are 1 to 5 percent.

Typical pedon of Shellabarger fine sandy loam, 3 to 5 percent slopes, in a wheat field 2,600 feet north and 500 feet west of the southeast corner of sec. 11, T. 8 N., R. 15 W.

Ap—0 to 8 inches; reddish brown (5YR 5/3) winnowed fine sandy loam, dark reddish brown (5YR 3/3) moist; weak fine and medium granular structure; hard, friable; medium acid; gradual smooth boundary.

A1—8 to 13 inches; reddish brown (5YR 4/3) fine sandy loam, dark reddish brown (5YR 3/3) moist; weak medium granular structure; hard, friable; slightly acid; clear smooth boundary.

B1—13 to 18 inches; reddish brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure; hard, friable; neutral; clear smooth boundary.

B2t—18 to 42 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; weak medium subangular blocky structure; hard, firm; thin discontinuous clay films on ped faces; neutral; gradual smooth boundary.

B3—42 to 53 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; weak fine and medium granular structure; hard, friable; neutral; gradual smooth boundary.

C—53 to 72 inches; red (2.5YR 5/6) fine sandy loam, red (2.5YR 4/6) moist; massive; hard, friable; neutral.

The solum is 30 to 53 inches thick. The depth to bedrock is more than 72 inches. Buried horizons are common below a depth of 5 feet. The surface layer is medium acid to neutral and the lower part of the solum is slightly acid to mildly alkaline. The C horizon is neutral to mildly alkaline.

The A horizon has hue of 7.5YR or 5YR, value of 3 through 5, and chroma of 2 or 3. Where present, the B1 horizon ranges in texture from fine sandy loam to sandy clay loam. It has hue of 7.5YR or 5YR, value of 3 through 5, and chroma of 3 or 4. The B2t horizon typically is sandy clay loam, but it ranges to sandy loam. It has hue of 5YR or 2.5YR, value of 4 through 6, and chroma of 3 through 6. The B3 horizon, where present, is light sandy clay loam or fine sandy loam. It has hue of 5YR or 2.5YR, value of 4 through 6, and chroma of 3 through 6. The C horizon ranges from sandy loam to loamy sand. It has hue of 2.5YR or 5YR and value and chroma of 4 through 6.

Shellabarger soils are similar to Binger soils. Unlike Shellabarger soils, Binger soils have sandstone between depths of 20 and 40 inches.

St. Paul series

The St. Paul series consists of deep, well drained soils that have moderately slow permeability. These soils formed in material that weathered from loamy sediment or redbed residuum under a cover of tall and mid grasses. They are on hillsides and hilltops, in swales, and on benches on uplands. Slopes are 0 to 5 percent.

Typical pedon of St. Paul silt loam, 0 to 1 percent slopes, in a cultivated field 2,540 feet south and 50 feet west of the northeast corner of sec. 8, T. 9 N., R. 16 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable; many fine roots; slightly acid; abrupt smooth boundary.

A1—9 to 16 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; hard, friable; many fine roots; neutral; gradual smooth boundary.

B1—16 to 21 inches; brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure; very hard, firm; few fine roots; mildly alkaline; gradual smooth boundary.

B2t—21 to 38 inches; reddish brown (5YR 5/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate medium subangular blocky structure; very hard, firm; thin continuous clay films; few small calcium carbonate concretions in lower part; few fine roots; mildly alkaline; gradual smooth boundary.

B3—38 to 42 inches; light reddish brown (5YR 6/3) silty clay loam, reddish brown (5YR 4/3) moist; weak medium subangular blocky structure; very hard, firm; patchy clay films; few fine roots; about 10 percent is soft powdery lime and concretions; calcareous; moderately alkaline; gradual smooth boundary.

C—42 to 60 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; massive; hard, friable; about 10 percent is soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to more than 60 inches thick. The depth to soft powdery lime is 30 to 45 inches; the average depth is about 44 inches. The surface layer is slightly acid to neutral, and the lower part of the solum is neutral to moderately alkaline. The C horizon is moderately alkaline and calcareous.

The A horizon has hue of 10YR or 5YR, value of 3 through 5, and chroma of 2 or 3. The B1 horizon, where present, is silt loam or silty clay loam, and its colors are the same as those of the A horizon. The B2t horizon is silty clay loam or clay loam that is 27 to 37 percent clay. The B2t horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 2 through 4. The B3 horizon is silty clay loam, clay loam, or silt loam and is 25 to 37 percent clay. It has hue of 7.5YR through 2.5YR, value of 4 through 6, and chroma of 3 through 6. The C horizon is silt loam, silty clay loam, or clay loam. It has hue of 5YR or 2.5YR and value and chroma of 4 through 6.

St. Paul soils are similar to Carey, Abilene, Pond Creek, and Obaro soils. St. Paul soils have a thicker and darker colored surface layer and a more clayey Bt horizon than Carey soils. They have a less clayey Bt horizon than Abilene soils. Pond Creek soils have a siltier surface layer and carbonates that are leached to a greater depth than St. Paul soils. Unlike St. Paul soils, Obaro soils are calcareous throughout and have a thin, light colored surface layer.

Vernon series

The Vernon series consists of moderately deep, well drained, very slowly permeable soils on uplands. These soils formed in material that weathered from clay and shale under a cover of short and mid grasses. They are on hillsides and hilltops and in swales. Slopes are mainly 2 to 12 percent.

Typical pedon of Vernon silty clay loam, in an area of Vernon-Rock outcrop complex, 2 to 12 percent slopes, in native range 400 feet east and 600 feet north of the southwest corner of sec. 36, T. 8 N., R. 19 W.

A1—0 to 6 inches; dark brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; hard, friable; calcareous; moderately alkaline; clear smooth boundary.

B2—6 to 26 inches; weak red (2.5YR 5/2) clay, weak red (2.5YR 4/2) moist; moderate medium subangular blocky structure; very hard, firm; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

Cr—26 to 43 inches; reddish brown (2.5YR 5/4) shaly clay, reddish brown (2.5YR 4/4) moist; massive; very hard, firm; few fine concretions; calcareous; moderately alkaline.

The solum is 20 to 33 inches thick. In the upper part of the solum the soil material is mildly alkaline to moderately alkaline, and in the lower part of the solum and in the C horizon it is moderately alkaline.

The A horizon is silty clay loam or clay. It has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 2 or 3. The B horizon is a clay that is 40 to 50 percent clay. It has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 2 to 4. Structure is weak to moderate, medium subangular blocky or blocky. The Cr horizon is clay, and it is as much as 50 percent strata of olive gray (5Y 5/2) shale. In a few pedons, interbedded limestone that is 1 to 2 feet thick is below a depth of 20 inches.

Vernon soils are associated with St. Paul and Obaro soils. They are not so dark colored in the surface layer as St. Paul soils, and they have less distinct horizons than those soils. They are more clayey than Obaro soils.

Woodward series

The Woodward series consists of moderately deep, well drained soils that formed in calcareous, weakly consolidated sandstone or sandy siltstone under a cover of mid and tall grasses. These soils are on hilltops and hillsides, in swales, and along canyons on uplands. Slopes are mainly 1 to 8 percent, but they range to 45 percent on canyon escarpments, where these soils are mapped in a complex with other soils.

Typical pedon of Woodward silt loam, 3 to 5 percent slopes, in a cultivated field about 900 feet west and 100 feet south of the northeast corner of sec. 6, T. 11 N., R. 16 W.

Ap—0 to 8 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, friable; many roots; common worm casts; calcareous; moderately alkaline; abrupt smooth boundary.

B2—8 to 26 inches; light reddish brown (5YR 6/4) silt loam, reddish brown (5YR 5/4) moist; moderate fine and medium granular structure; slightly hard; friable; many roots; common worm casts; calcareous; moderately alkaline; diffuse smooth boundary.

B3—26 to 38 inches; red (2.5YR 5/6) silt loam, red (2.5YR 4/6) moist; weak fine granular structure; slightly hard, friable; few roots; few threads and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cr—38 to 40 inches; red (2.5YR 5/6) weakly consolidated silty sandstone, red (2.5YR 4/6) moist.

The solum is 20 to 40 inches thick. The soil material is calcareous throughout. Soft powdery lime is within a depth of 36 inches.

The A horizon is silt loam or loam. It has hue of 7.5YR to 2.5YR, value of 4 through 6, and chroma of 3 through 6. Where this horizon has chroma of less than 3.5, the thickness of the horizon is less than one-third that of the solum. The B horizon is loam or silt loam. It has hue of 5YR or 2.5YR and value and chroma of 4 through 6. The

Cr horizon is weakly consolidated sandstone or sandy siltstone that typically is calcareous and moderately alkaline but ranges to noncalcareous and mildly alkaline.

Woodward soils are similar to Dill, Hardeman, and Quinlan soils. Dill and Hardeman soils are noncalcareous, and they are sandier than Woodward soils. Quinlan soils are less than 20 inches deep.

Yahola series

The Yahola series consists of deep, well drained soils that formed in loamy, calcareous sediment. These soils are on flood plains that originally were covered with tall grasses and scattered hardwood trees. They are subject to flooding once in 1 to 5 years. Slopes are mainly 0 to 1 percent, but in a few small areas they range to 3 percent.

Typical pedon of Yahola fine sandy loam in a cultivated field about 2,400 feet north and 1,000 feet east of the southwest corner of sec. 2, T. 8 N., R. 15 W.

Ap—0 to 6 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and medium granular structure; soft, very friable; many fine roots; calcareous, moderately alkaline; gradual smooth boundary.

A12—6 to 11 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and medium granular structure; soft, very friable; many fine roots; calcareous; moderately alkaline; gradual smooth boundary.

C—11 to 72 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; stratified with thin layers of reddish brown (5YR 5/4) loam; massive; slightly hard, very friable; common roots; evident bedding planes; calcareous; moderately alkaline.

Typically, the soil material is calcareous throughout, but in a few areas it is noncalcareous to a depth of 10 inches. In some pedons buried horizons are below a depth of 35 inches.

The A horizon has hue of 7.5YR to 2.5YR, value of 4 through 6, and chroma of 3 through 6. Where this horizon has chroma of less than 3.5, the organic matter content is less than one percent. The C horizon, to a depth of 40 inches, is fine sandy loam or loam that is 8 to 18 percent clay; below a depth of 40 inches it is loamy fine sand. There are thin strata of coarser or finer textured material throughout the C horizon.

Yahola soils are similar to Clairemont, Port, and Reinach soils. Unlike Yahola soils, Clairemont and Port soils are more than 18 percent clay between depths of 10 and 40 inches, and Port and Reinach soils have a dark colored, noncalcareous surface layer that is more than 20 inches thick.

References

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(3) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. Supplements replacing pp. 173-188 issued May 1962

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Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A

blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden

deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years.

Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. Hydrous calcium sulphate.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2

to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characterisitc that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except

for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na@ to Ca@@ Mg@@. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitaion is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

ILLUSTRATIONS

Figure 1.—Typical landscape of Cordell-Rock outcrop complex, 2 to 15 percent slopes.

Figure 2.—This area of Port silt loam is flooded after a 4-inch rain.

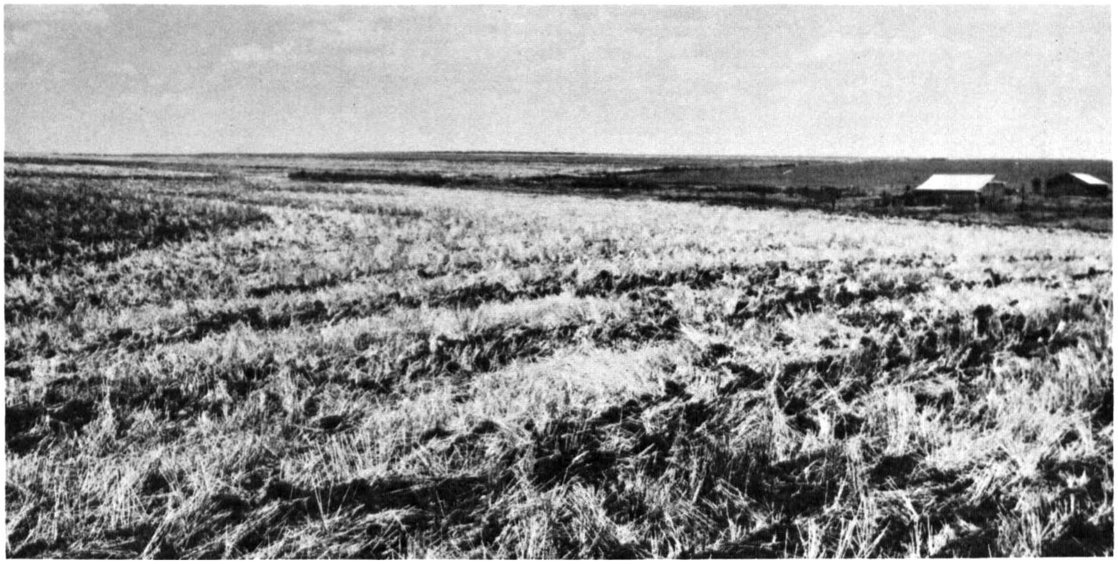

Figure 3.—Wheat residue management on St. Paul silt loam, 1 to 3 percent slopes.

Figure 4.—Woodland on Clairemont soils provides habitat for wild turkey and other wildlife.

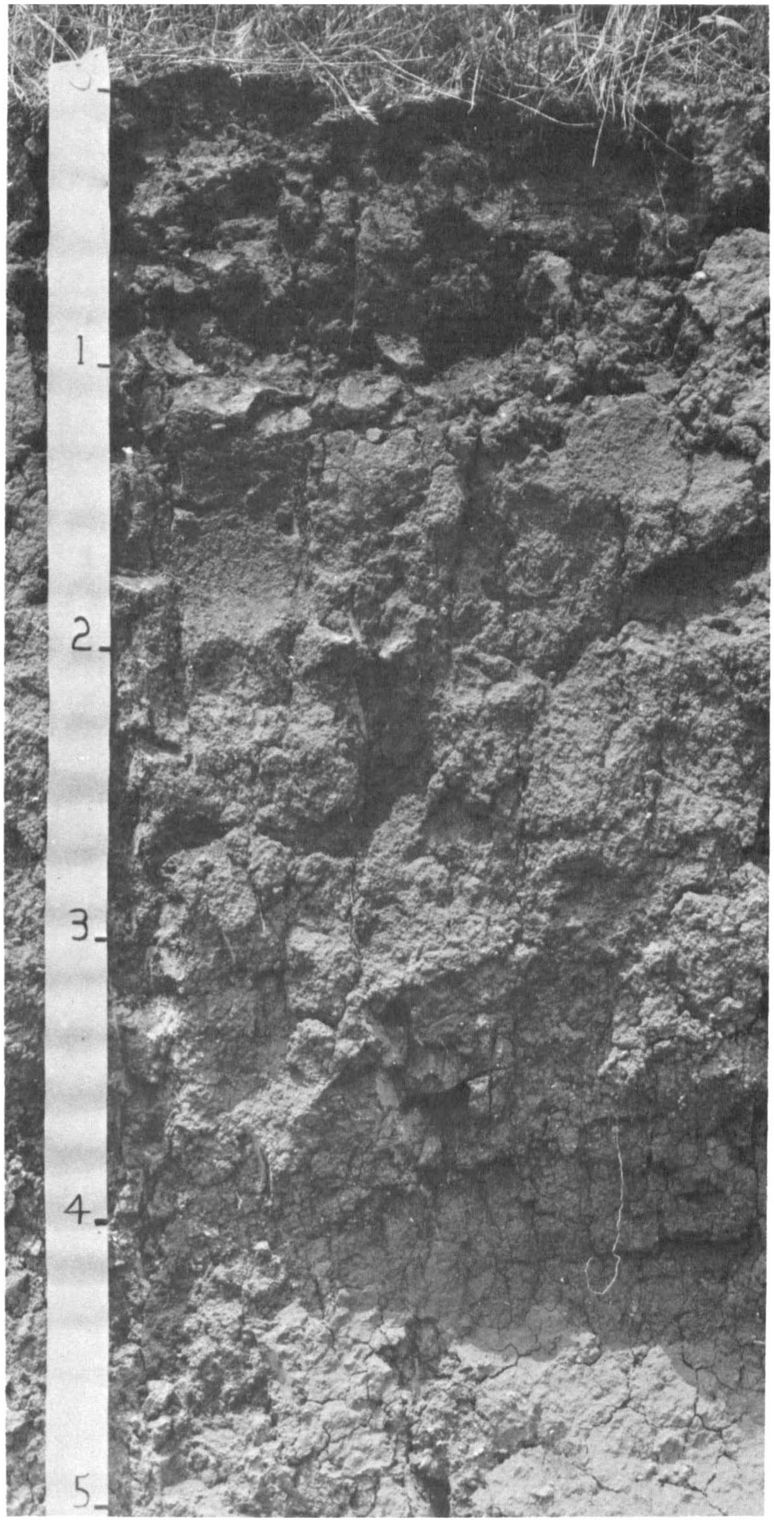

Figure 5.—Profile of Abilene silt loam showing the dark surface layer and the prismatic structure in the lower part of the subsoil.

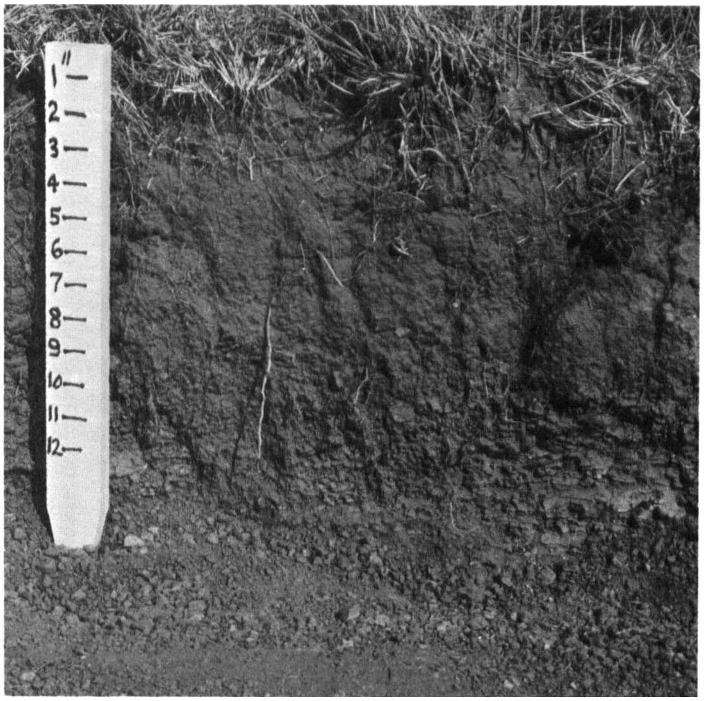

Figure 6.—Profile of Cordell silty clay loam, a soil that formed in red shale of the Doxey Formation.

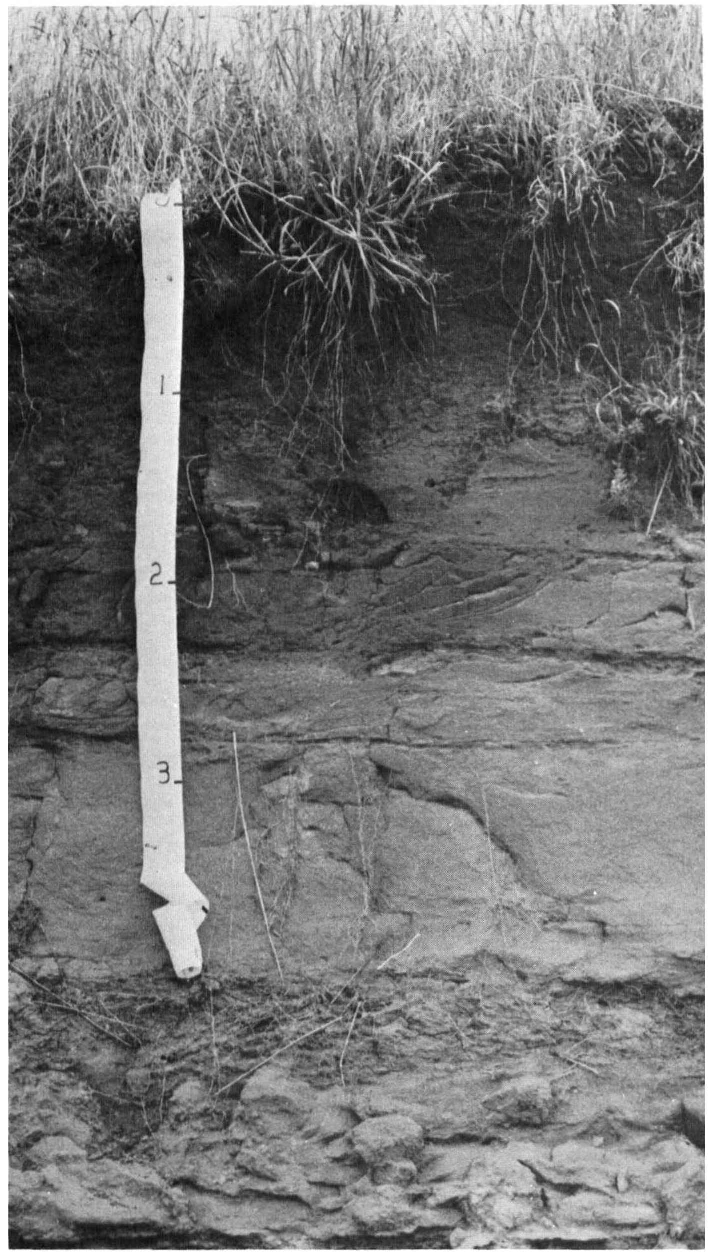

Figure 7.—Profile of Quinlan fine sandy loam showing the weakly cemented sandstone strata below a depth of about 17 inches.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	50.4	25.1	37.8	76	1	15	.64	.09	1.05	2	2.4
February---	55.9	29.3	42.6	80	7	30	.98	.22	1.57	2	2.2
March------	64.0	36.2	50.1	91	13	157	1.64	.34	2.66	4	1.4
April------	74.4	47.4	60.9	94	25	339	2.27	.73	3.48	4	.1
May--------	82.7	56.8	69.8	102	37	614	4.13	1.53	6.22	5	.0
June-------	91.3	66.0	78.6	105	50	858	3.04	1.45	4.32	5	.0
July-------	96.0	70.4	83.2	108	57	1,029	2.56	.94	3.86	4	.0
August-----	95.3	68.8	82.1	108	55	995	2.64	.69	4.19	4	.0
September--	86.8	61.1	74.0	103	43	720	3.07	.78	4.88	4	.0
October----	75.9	50.1	63.0	95	30	403	2.87	.99	4.39	4	.0
November---	61.5	37.0	49.2	82	16	82	1.28	.09	2.17	2	.5
December---	52.3	28.6	40.5	77	6	14	1.00	.32	1.54	2	1.9
Year-----	73.9	48.1	61.0	110	0	5,256	26.12	20.10	31.76	42	8.5

[1] Recorded in the period 1951-74 at Cordell, Okla.

[2] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1] 24° F or lower	Temperature[1] 28° F or lower	Temperature[1] 32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 3	April 14	April 23
2 years in 10 later than--	March 28	April 8	April 18
5 years in 10 later than--	March 17	March 30	April 9
First freezing temperature in fall:			
1 year in 10 earlier than--	November 3	October 27	October 18
2 years in 10 earlier than--	November 11	November 1	October 23
5 years in 10 earlier than--	November 25	November 11	November 2

[1] Recorded in the period 1951-74 at Cordell, Okla.

TABLE 3.--GROWING SEASON LENGTH

Probability	Daily minimum temperature during growing season[1] Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	221	202	184
8 years in 10	232	210	192
5 years in 10	253	225	206
2 years in 10	273	241	220
1 year in 10	284	249	228

[1] Recorded in the period 1951-74 at Cordell, Okla.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Abilene silt loam, 0 to 1 percent slopes	1,710	0.3
2	Altus and Grandfield soils, 0 to 1 percent slopes	6,075	1.0
3	Altus and Grandfield soils, 1 to 3 percent slopes	4,200	0.7
4	Amber very fine sandy loam, 3 to 8 percent slopes	894	0.1
5	Binger fine sandy loam, 1 to 3 percent slopes	1,410	0.2
6	Binger fine sandy loam, 3 to 5 percent slopes	1,285	0.2
7	Carey silt loam, 1 to 3 percent slopes	35,665	5.5
8	Carey silt loam, 3 to 5 percent slopes	37,372	5.8
9	Clairemont silt loam, occasionally flooded	27,762	4.3
10	Clairemont silt loam, frequently flooded	5,460	0.9
11	Cordell silty clay loam, 1 to 5 percent slopes	18,090	2.8
12	Cordell-Rock outcrop complex, 2 to 15 percent slopes	44,512	6.9
13	Cornick-Rock outcrop complex, 1 to 12 percent slopes	9,618	1.5
14	Devol loamy fine sand, 0 to 3 percent slopes (W)	1,429	0.2
15	Devol loamy fine sand, 3 to 8 percent slopes (W)	3,324	0.5
16	Devol-Grandfield complex, 0 to 3 percent slopes (W)	4,755	0.7
17	Devol-Grandfield complex, 3 to 8 percent slopes (W)	4,835	0.8
18	Dill fine sandy loam, 1 to 3 percent slopes	6,445	1.0
19	Dill-Quinlan complex, 1 to 3 percent slopes	14,407	2.2
20	Dill-Quinlan complex, 3 to 5 percent slopes	15,631	2.4
21	Dill-Quinlan complex, 5 to 12 percent slopes	11,633	1.8
22	Dodson silt loam, 0 to 1 percent slopes	7,498	1.2
23	Dougherty-Eufaula complex, 3 to 8 percent slopes (W)	1,127	0.2
24	Grandfield fine sandy loam, 0 to 1 percent slopes	3,220	0.5
25	Grandfield fine sandy loam, 1 to 3 percent slopes	35,805	5.5
26	Grandfield fine sandy loam, 3 to 5 percent slopes	13,125	2.0
27	Hardeman fine sandy loam, 1 to 3 percent slopes	4,030	0.6
28	Hardeman fine sandy loam, 3 to 5 percent slopes	6,824	1.1
29	Hardeman fine sandy loam, 5 to 8 percent slopes	2,539	0.4
30	Obaro silty clay loam, 1 to 3 percent slopes	11,058	1.7
31	Obaro silty clay loam, 3 to 5 percent slopes	17,427	2.7
32	Obaro silty clay loam, 2 to 5 percent slopes, eroded	28,751	4.5
33	Pond Creek fine sandy loam, 0 to 1 percent slopes	4,064	0.6
34	Pond Creek fine sandy loam, 1 to 3 percent slopes	7,213	1.1
35	Port silt loam	11,043	1.7
36	Pratt loamy fine sand, 5 to 12 percent slopes (W)	924	0.1
37	Quinlan-Obaro complex, 5 to 12 percent slopes	13,943	2.2
38	Quinlan-Rock outcrop complex, 8 to 20 percent slopes	2,145	0.3
39	Quinlan-Woodward complex, 2 to 5 percent slopes, eroded	10,394	1.6
40	Quinlan-Woodward complex, 5 to 12 percent slopes	16,378	2.5
41	Quinlan and Dill soils, 2 to 12 percent slopes, severely eroded	3,366	0.5
42	Reinach silt loam	7,652	1.2
43	Retrop silty clay loam	2,748	0.4
44	Shellabarger fine sandy loam, 1 to 3 percent slopes	9,640	1.5
45	Shellabarger fine sandy loam, 3 to 5 percent slopes	7,882	1.2
46	St. Paul silt loam, 0 to 1 percent slopes	14,481	2.2
47	St. Paul silt loam, 1 to 3 percent slopes	86,032	13.3
48	St. Paul silt loam, 3 to 5 percent slopes	5,843	0.9
49	Vernon-Rock outcrop complex, 2 to 12 percent slopes	815	0.1
50	Woodward silt loam, 1 to 3 percent slopes	3,381	0.5
51	Woodward silt loam, 3 to 5 percent slopes	6,542	1.0
52	Woodward silt loam, 5 to 8 percent slopes	3,186	0.5
53	Woodward-Clairemont complex	9,344	1.5
54	Woodward-Quinlan complex, 1 to 3 percent slopes	2,534	0.4
55	Woodward-Quinlan complex, 3 to 5 percent slopes	26,054	4.0
56	Yahola fine sandy loam	2,176	0.4
	Water	704	0.1
	Total	646,400	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield figure indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Wheat	Grain sorghum	Cotton lint	Alfalfa hay	Improved bermudagrass	Weeping lovegrass
	Bu	Bu	Lb	Ton	AUM*	AUM
1 Abilene	25	35	275	---	4.6	4.0
2 Altus	28	45	400	2.8	7.0	7.5
3 Altus	23	40	350	2.3	6.5	7.0
4 Amber	20	35	300	2.0	6.0	6.5
5 Binger	20	35	300	---	6.0	6.5
6 Binger	15	25	250	---	5.5	6.0
7 Carey	20	30	275	---	5.0	4.0
8 Carey	15	25	200	---	4.6	4.0
9, 10 Clairemont	25	40	350	2.8	6.8	4.8
11 Cordell	15	---	---	---	3.0	2.8
12 Cordell	---	---	---	---	---	---
13 Cornick	---	---	---	---	---	---
14 Devol	20	30	250	3.0	4.6	5.8
15 Devol	15	25	200	---	4.4	5.4
16 Devol	20	30	225	---	4.8	5.8
17 Devol	15	20	---	---	4.6	5.6
18 Dill	20	30	300	---	6.0	6.5
19 Dill	19	29	300	---	5.2	5.6
20 Dill	15	25	225	---	4.8	5.0
21 Dill	---	---	---	---	---	3.0
22 Dodson	22	30	275	---	4.4	3.4

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat	Grain sorghum	Cotton lint	Alfalfa hay	Improved bermudagrass	Weeping lovegrass
	Bu	Bu	Lb	Ton	AUM*	AUM*
23 Dougherty	75	25	---	---	5.0	5.6
24 Grandfield	25	35	350	2.5	6.5	7.0
25 Grandfield	20	35	300	2.0	6.0	6.5
26 Grandfield	20	30	250	2.0	5.5	6.0
27 Hardeman	20	30	300	2.0	6.0	6.5
28 Hardeman	18	25	200	1.5	5.5	6.0
29 Hardeman	15	20	150	---	5.0	5.0
30 Obaro	15	25	200	---	4.2	3.2
31 Obaro	15	20	150	---	4.2	3.2
32 Obaro	10	15	100	---	3.8	2.8
33 Pond Creek	35	50	450	3.5	7.5	7.8
34 Pond Creek	30	45	400	3.0	7.0	7.8
35 Port	35	50	500	5.0	8.5	5.5
36 Pratt	12	16	---	---	4.0	3.0
37 Quinlan	---	---	---	---	---	---
38 Quinlan	---	---	---	---	---	---
39 Quinlan	---	---	---	---	---	---
40 Quinlan	11	18	175	---	3.4	3.4
41 Quinlan	---	---	---	---	---	3.0
42 Reinach	35	50	500	5.0	6.4	7.0
43 Retrop	---	---	---	---	6.4	---
44 Shellabarger	20	35	330	2.2	6.0	6.5
45 Shellabarger	17	42	250	---	5.2	6.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat	Grain sorghum	Cotton lint	Alfalfa hay	Improved bermudagrass	Weeping lovegrass
	Bu	Bu	Lb	Ton	AUM*	AUM*
46------------------------ St. Paul	25	35	350	2.2	5.0	4.6
47------------------------ St. Paul	20	30	300	2.0	5.0	4.4
48------------------------ St. Paul	15	20	250	1.6	4.5	3.9
49------------------------ Vernon	---	---	---	---	---	---
50------------------------ Woodward	20	30	300	---	5.0	4.5
51------------------------ Woodward	15	25	200	---	4.5	4.0
52------------------------ Woodward	15	18	---	---	4.0	3.8
53------------------------ Woodward	---	---	---	---	---	---
54------------------------ Woodward	18	28	---	---	4.0	3.8
55------------------------ Woodward	13	23	---	---	3.6	3.8
56------------------------ Yahola	30	50	425	3.5	7.5	8.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
1: Abilene	Hardland	Favorable	2,500	Sideoats grama	20
		Normal	2,000	Vine-mesquite	15
		Unfavorable	1,300	Arizona cottontop	15
				Buffalograss	10
				Western wheatgrass	5
				Silver bluestem	5
				Texas needlegrass	5
				Tobosa	5
				White tridens	5
2*, 3*:					
Altus	Sandy Prairie	Favorable	3,800	Little bluestem	25
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Sideoats grama	15
				Blue grama	10
				Indiangrass	5
				Texas needlegrass	5
				Sand lovegrass	5
				Sand sagebrush	5
Grandfield	Sandy Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Sideoats grama	15
				Blue grama	10
				Indiangrass	5
				Texas needlegrass	5
				Sand lovegrass	5
				Sand sagebrush	5
4: Amber	Loamy Bottomland	Favorable	7,200	Big bluestem	25
		Normal	5,200	Indiangrass	15
		Unfavorable	3,800	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedge	5
5, 6: Binger	Sandy Prairie	Favorable	3,800	Little bluestem	30
		Normal	2,700	Sand bluestem	15
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
7, 8: Carey	Loamy Prairie	Favorable	4,200	Blue grama	20
		Normal	2,900	Sideoats grama	15
		Unfavorable	2,000	Buffalograss	15
				Arizona cottontop	5
				Plains bristlegrass	5
				Vine-mesquite	5
				Texas needlegrass	5
				Sand dropseed	5
				Hairy grama	5
9, 10: Clairemont	Loamy Bottomland	Favorable	7,000	Sideoats grama	20
		Normal	4,600	Sand bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Vine-mesquite	10
				Switchgrass	5
				Little bluestem	5
				Western wheatgrass	5
				Arizona cottontop	5
				Texas needlegrass	5
				Plains bristlegrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
11 Cordell	Red Shale	Favorable	1,400	Little bluestem	25
		Normal	950	Sideoats grama	20
		Unfavorable	700	Blue grama	20
				Buffalograss	10
				Hairy grama	5
12*:					
Cordell	Red Shale	Favorable	1,400	Little bluestem	25
		Normal	950	Sideoats grama	20
		Unfavorable	700	Blue grama	20
				Buffalograss	10
				Hairy grama	5
Rock outcrop.					
13*:					
Cornick	Gyp	Favorable	1,300	Little bluestem	25
		Normal	800	Sideoats grama	20
		Unfavorable	600	Blue grama	10
				Sand dropseed	5
				Hairy tridens	5
Rock outcrop.					
14, 15 Devol	Deep Sand	Favorable	3,700	Sand bluestem	25
		Normal	2,600	Little bluestem	15
		Unfavorable	1,900	Indiangrass	10
				Sand lovegrass	10
				Texas needlegrass	5
				Sideoats grama	5
				Sand sagebrush	5
				Skunkbush sumac	5
16*, 17*:					
Devol	Deep Sand	Favorable	3,700	Sand bluestem	25
		Normal	2,600	Little bluestem	15
		Unfavorable	1,900	Indiangrass	10
				Sand lovegrass	10
				Texas needlegrass	5
				Sideoats grama	5
				Sand sagebrush	5
				Skunkbush sumac	5
Grandfield	Deep Sand	Favorable	3,700	Sand bluestem	25
		Normal	2,600	Little bluestem	15
		Unfavorable	1,900	Indiangrass	10
				Sand lovegrass	10
				Texas needlegrass	5
				Sideoats grama	5
				Sand sagebrush	5
				Skunkbush sumac	5
				Switchgrass	5
18 Dill	Sandy Prairie	Favorable	3,800	Little bluestem	25
		Normal	2,700	Sand bluestem	20
		Unfavorable	2,000	Sideoats grama	15
				Blue grama	10
				Indiangrass	5
				Texas needlegrass	5
				Sand lovegrass	5
				Sand sagebrush	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
19*, 20*, 21*:					
Dill	Sandy Prairie	Favorable	3,800	Little bluestem	25
		Normal	2,700	Sand bluestem	20
		Unfavorable	2,000	Sideoats grama	15
				Blue grama	10
				Indiangrass	5
				Texas needlegrass	5
				Sand lovegrass	5
				Sand sagebrush	5
Quinlan	Shallow Prairie	Favorable	2,500	Little bluestem	30
		Normal	1,800	Big bluestem	15
		Unfavorable	1,300	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
22 Dodson	Hardland	Favorable	2,500	Blue grama	30
		Normal	2,000	Buffalograss	15
		Unfavorable	1,500	Sideoats grama	10
				Vine-mesquite	5
				Western wheatgrass	5
				Tobosa	5
				Arizona cottontop	5
				White tridens	5
				Hairy grama	5
23*:					
Dougherty	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Sideoats grama	5
				Lespedeza	5
Eufaula	Deep Sand Savannah	Favorable	4,000	Little bluestem	25
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Indiangrass	5
				Switchgrass	5
				Purpletop	5
				Arrowfeather threeawn	5
				Scribner panicum	5
				Sideoats grama	5
				Lespedeza	5
24, 25, 26 Grandfield	Sandy Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Sideoats grama	15
				Blue grama	10
				Indiangrass	5
				Texas needlegrass	5
				Sand lovegrass	5
				Sand sagebrush	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
27, 28, 29 Hardeman	Sandy Prairie	Favorable	4,000	Sideoats grama	20
		Normal	2,800	Little bluestem	15
		Unfavorable	2,000	Plains bristlegrass	15
				Blue grama	10
				Vine-mesquite	10
				Arizona cottontop	10
				Sand dropseed	5
				Buffalograss	5
30, 31, 32 Obaro	Loamy Prairie	Favorable	3,800	Blue grama	25
		Normal	2,500	Buffalograss	15
		Unfavorable	1,700	Sideoats grama	10
				Arizona cottontop	5
				Little bluestem	5
				Plains bristlegrass	5
				Hairy grama	5
				Silver bluestem	5
				Sand dropseed	5
33, 34 Pond Creek	Sandy Prairie	Favorable	4,000	Little bluestem	30
		Normal	2,800	Big bluestem	15
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Prairie-clover	5
				Halfshrub sundrop	5
				Scribner panicum	5
				Sand paspalum	5
				Yucca	5
35 Port	Loamy Bottomland	Favorable	7,500	Sand bluestem	25
		Normal	4,700	Indiangrass	15
		Unfavorable	3,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Heath aster	5
				Sedge	5
36 Pratt	Deep Sand	Favorable	4,000	Sand bluestem	25
		Normal	2,800	Little bluestem	20
		Unfavorable	2,000	Indiangrass	10
				Sand lovegrass	10
				Switchgrass	5
				Blue grama	5
				Texas bluegrass	5
				Sand dropseed	5
37*:					
Quinlan	Shallow Prairie	Favorable	2,500	Little bluestem	30
		Normal	1,800	Big bluestem	15
		Unfavorable	1,300	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
37*:					
Obaro	Loamy Prairie	Favorable	3,800	Blue grama	25
		Normal	2,500	Buffalograss	15
		Unfavorable	1,700	Sideoats grama	10
				Arizona cottontop	5
				Little bluestem	5
				Plains bristlegrass	5
				Hairy grama	5
				Silver bluestem	5
				Sand dropseed	5
38*:					
Quinlan	Shallow Prairie	Favorable	2,500	Little bluestem	30
		Normal	1,800	Big bluestem	15
		Unfavorable	1,300	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
Rock outcrop.					
39*, 40*:					
Quinlan	Shallow Prairie	Favorable	2,500	Little bluestem	30
		Normal	1,800	Big bluestem	15
		Unfavorable	1,300	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
Woodward	Loamy Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	10
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Canada wildrye	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
41*:					
Quinlan	Eroded Prairie	Favorable	1,800	Little bluestem	35
		Normal	1,200	Big bluestem	10
		Unfavorable	800	Tall dropseed	10
				Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Prairie-clover	5
				Blue grama	5
				Heath aster	5
				Sunflower	5
Dill	Eroded Prairie	Favorable	2,700	Little bluestem	35
		Normal	1,900	Sand bluestem	15
		Unfavorable	1,400	Blue grama	10
				Sideoats grama	5
				Indiangrass	5
				Texas needlegrass	5
				Sand lovegrass	5
				Sand sagebrush	5
				Threeawn	5
				Purple lovegrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
42: Reinach	Loamy Bottomland	Favorable	7,300	Big bluestem	25
		Normal	5,200	Indiangrass	15
		Unfavorable	3,800	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Heath aster	5
				Sedge	5
43: Retrop	Subirrigated	Favorable	9,000	Switchgrass	25
		Normal	7,200	Big bluestem	20
		Unfavorable	6,000	Indiangrass	10
				Eastern gamagrass	10
				Canada wildrye	5
				Maximilian sunflower	5
44, 45: Shellabarger	Sandy Prairie	Favorable	4,500	Sand bluestem	35
		Normal	3,200	Little bluestem	25
		Unfavorable	2,500	Indiangrass	15
				Switchgrass	10
46, 47, 48: St. Paul	Loamy Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	10
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Canada wildrye	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
49*:					
Vernon	Red Clay Prairie	Favorable	1,750	Sideoats grama	25
		Normal	1,350	Buffalograss	15
		Unfavorable	900	Tobosa	15
				Vine-mesquite	5
				Hairy grama	5
				Silver bluestem	5
				Arizona cottontop	5
				Blue grama	5
Rock outcrop.					
50, 51, 52: Woodward	Loamy Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	10
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Canada wildrye	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
53*:					
Woodward	Loamy Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	10
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Canada wildrye	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
53*:					
Clairemont	Loamy Bottomland	Favorable	7,000	Sideoats grama	20
		Normal	4,600	Sand bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Vine-mesquite	10
				Switchgrass	5
				Little bluestem	5
				Western wheatgrass	5
				Arizona cottontop	5
				Texas needlegrass	5
				Plains bristlegrass	5
54*, 55*:					
Woodward	Loamy Prairie	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	20
		Unfavorable	2,000	Switchgrass	10
				Indiangrass	10
				Sideoats grama	5
				Blue grama	5
				Canada wildrye	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
Quinlan	Shallow Prairie	Favorable	2,000	Little bluestem	30
		Normal	1,400	Big bluestem	15
		Unfavorable	1,000	Indiangrass	10
				Switchgrass	10
				Tall dropseed	10
				Scribner panicum	5
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
56 Yahola	Loamy Bottomland	Favorable	6,000	Big bluestem	25
		Normal	3,900	Indiangrass	15
		Unfavorable	2,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedge	5
				Heath aster	5

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1: Abilene	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
2*, 3*:					
Altus	Slight	Slight	Slight	Slight	Moderate: low strength.
Grandfield	Slight	Slight	Slight	Slight	Moderate: low strength.
4: Amber	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
5: Binger	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: low strength.
6: Binger	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
7, 8: Carey	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
9, 10: Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
11: Cordell	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
12*:					
Cordell	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop.					
13*:					
Cornick	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Rock outcrop.					
14: Devol	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
15: Devol	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
16*:					
Devol	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Grandfield	Slight	Slight	Slight	Slight	Moderate: low strength.
17*:					
Devol	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Grandfield	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
18 Dill	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Slight.
19*:					
Dill	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Slight.
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength, depth to rock.
20*:					
Dill	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength, depth to rock.
21*:					
Dill	Moderate: depth to rock.	Moderate: slope.	Moderate: depth to rock.	Severe: slope.	Moderate: slope.
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: low strength, depth to rock.
22 Dodson	Moderate: too clayey.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
23*:					
Dougherty	Moderate: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: low strength.
Eufaula	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
24, 25 Grandfield	Slight	Slight	Slight	Slight	Moderate: low strength.
26 Grandfield	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
27 Hardeman	Slight	Slight	Slight	Slight	Moderate: low strength.
28, 29 Hardeman	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
30 Obaro	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength.
31 Obaro	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: depth to rock, slope.	Moderate: low strength.
32 Obaro	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength.
33, 34 Pond Creek	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
35 Port	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, shrink-swell, floods.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
36 Pratt	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
37*:					
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: low strength, depth to rock.
Obaro	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Severe: slope.	Moderate: low strength.
38*:					
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: low strength, depth to rock.
Rock outcrop.					
39*:					
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength, depth to rock.
Woodward	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
40*:					
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: low strength, depth to rock.
Woodward	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Severe: slope.	Moderate: low strength.
41*:					
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength, depth to rock.
Dill	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
42 Reinach	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength, floods.
43 Retrop	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: floods.
44 Shellabarger	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
45 Shellabarger	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
46, 47, 48 St. Paul	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
49*:					
Vernon	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Rock outcrop.					

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
50, 51, 52-------- Woodward	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
53*:					
Woodward---------	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Severe: slope.	Moderate: low strength.
Clairemont-------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
54*, 55*:					
Woodward---------	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Quinlan----------	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength, depth to rock.
56--------------- Yahola	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 8.--SANITARY FACILITIES

[Some of the terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Abilene	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
2*, 3*:					
Altus	Slight	Moderate: seepage.	Slight	Slight	Good.
Grandfield	Slight	Moderate: seepage.	Slight	Slight	Good.
4 Amber	Moderate: floods.	Moderate: seepage, slope.	Moderate: floods.	Moderate: floods.	Good.
5, 6 Binger	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
7, 8 Carey	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
9, 10 Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
11 Cordell	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
12*:					
Cordell	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Rock outcrop.					
13*:					
Cornick	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Rock outcrop.					
14, 15 Devol	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
16*, 17*:					
Devol	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Grandfield	Slight	Moderate: seepage.	Slight	Slight	Good.
18 Dill	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
19*, 20*:					
Dill	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Quinlan	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Poor: thin layer.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
21*:					
Dill	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Quinlan	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Moderate: slope.	Poor: thin layer.
22 Dodson	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
23*:					
Dougherty	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: too sandy.
Eufaula	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
24, 25, 26 Grandfield	Slight	Moderate: seepage.	Slight	Slight	Good.
27, 28, 29 Hardeman	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
30, 31, 32 Obaro	Moderate: percs slowly, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
33 Pond Creek	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
34 Pond Creek	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
35 Port	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
36 Pratt	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
37*:					
Quinlan	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Moderate: slope.	Poor: thin layer.
Obaro	Moderate: percs slowly, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer.
38*:					
Quinlan	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Moderate: slope.	Poor: thin layer.
Rock outcrop.					
39*:					
Quinlan	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Poor: thin layer.
Woodward	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
40*:					
Quinlan	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Moderate: slope.	Poor: thin layer.
Woodward	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer.
41*:					
Quinlan	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: depth to rock.	Slight	Poor: thin layer.
Dill	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
42 Reinach	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
43 Retrop	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
44, 45 Shellabarger	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
46 St. Paul	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
47, 48 St. Paul	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
49*:					
Vernon	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Rock outcrop.					
50, 51, 52 Woodward	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
53*:					
Woodward	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer.
Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
54*, 55*:					
Woodward	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
Quinlan	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Poor: thin layer.
56 Yahola	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 9.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1: Abilene	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
2*, 3*:				
Altus	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Grandfield	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
4: Amber	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
5, 6: Binger	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
7, 8: Carey	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
9, 10: Clairemont	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
11: Cordell	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, small stones, too clayey.
12*:				
Cordell	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, small stones, too clayey.
Rock outcrop.				
13*:				
Cornick	Poor: thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: thin layer.
Rock outcrop.				
14, 15: Devol	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
16*, 17*:				
Devol	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Grandfield	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
18: Dill	Fair: thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Good.
19*, 20*:				
Dill	Fair: thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Good.
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
21*:				
Dill	Fair: thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: slope.
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.
22 Dodson	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
23*:				
Dougherty	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Eufaula	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
24, 25, 26 Grandfield	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
27, 28, 29 Hardeman	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
30, 31, 32 Obaro	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
33, 34 Pond Creek	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
35 Port	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
36 Pratt	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy, slope.
37*:				
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.
Obaro	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
38*:				
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.
Rock outcrop.				
39*:				
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.
Woodward	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Good.
40*:				
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.
Woodward	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: slope.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
41*:				
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.
Dill	Fair: thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Good.
42 Reinach	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
43 Retrop	Fair: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
44, 45 Shellabarger	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
46, 47, 48 St. Paul	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
49*:				
Vernon	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Rock outcrop.				
50, 51, 52 Woodward	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Good.
53*:				
Woodward	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: slope.
Clairemont	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
54*, 55*:				
Woodward	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Good.
Quinlan	Fair: low strength.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Fair: thin layer.
56 Yahola	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 10.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1-----------------Abilene	Moderate: seepage.	Moderate: piping, compressible.	Severe: no water.	Not needed-----	Favorable------	Favorable.
2*, 3*:						
Altus------------	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: no water.	Not needed-----	Favorable------	Favorable.
Grandfield-------	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: no water.	Not needed-----	Favorable------	Favorable.
4-----------------Amber	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: deep to water.	Not needed-----	Erodes easily, floods.	Favorable.
5, 6--------------Binger	Severe: depth to rock.	Moderate: thin layer.	Severe: deep to water.	Not needed-----	Rooting depth	Rooting depth.
7, 8--------------Carey	Moderate: seepage.	Moderate: seepage, piping.	Severe: no water.	Not needed-----	Favorable------	Favorable.
9, 10-------------Clairemont	Moderate: seepage.	Slight---------	Severe: no water.	Not needed-----	Not needed-----	Erodes easily.
11----------------Cordell	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed-----	Depth to rock	Droughty, rooting depth.
12*:						
Cordell----------	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed-----	Not needed-----	Not needed.
Rock outcrop.						
13*:						
Cornick----------	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed-----	Depth to rock, erodes easily, rooting depth.	Droughty, erodes easily, rooting depth.
Rock outcrop.						
14, 15------------Devol	Severe: seepage.	Moderate: unstable fill, piping.	Severe: deep to water.	Not needed-----	Erodes easily	Erodes easily.
16*, 17*:						
Devol------------	Severe: seepage.	Moderate: unstable fill, piping.	Severe: deep to water.	Not needed-----	Erodes easily	Erodes easily.
Grandfield-------	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: no water.	Not needed-----	Favorable------	Favorable.
18----------------Dill	Severe: seepage.	Moderate: thin layer, unstable fill, piping.	Severe: no water.	Not needed-----	Depth to rock	Rooting depth.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
19*, 20*, 21*:						
Dill	Severe: seepage.	Moderate: thin layer, unstable fill, piping.	Severe: no water.	Not needed	Depth to rock	Rooting depth.
Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, slope.	Droughty, slope, rooting depth.
22 Dodson	Moderate: seepage.	Moderate: piping, compressible.	Severe: no water.	Not needed	Favorable	Favorable.
23*:						
Dougherty	Severe: seepage.	Moderate: unstable fill, compressible, piping.	Severe: no water.	Not needed	Erodes easily, too sandy.	Erodes easily, fast intake.
Eufaula	Severe: seepage.	Moderate: unstable fill, piping.	Severe: no water.	Not needed	Seepage, fast intake, droughty.	Erodes easily, droughty, fast intake.
24, 25, 26 Grandfield	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: no water.	Not needed	Favorable	Favorable.
27, 28, 29 Hardeman	Severe: seepage.	Moderate: unstable fill, piping, low strength.	Severe: no water.	Not needed	Seepage, erodes easily, slope.	Erodes easily, slope.
30, 31, 32 Obaro	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Not needed	Depth to rock, erodes easily, slope.	Erodes easily; slope.
33, 34 Pond Creek	Moderate: seepage.	Moderate: unstable fill, piping.	Severe: no water.	Not needed	Favorable	Favorable.
35 Port	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Severe: deep to water.	Not needed	Not needed	Not needed.
36 Pratt	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Not needed	Too sandy, soil blowing.	Slope.
37*:						
Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, slope.	Droughty, slope, rooting depth.
Obaro	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Not needed	Depth to rock, erodes easily, slope.	Erodes easily, slope.
38*:						
Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, slope.	Droughty, slope, rooting depth.
Rock outcrop.						
39*:						
Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, slope.	Droughty, slope, rooting depth.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
39*: Woodward	Severe: depth to rock.	Moderate: thin layer, unstable fill, compressible.	Severe: no water.	Not needed	Favorable	Favorable.
40*: Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, slope.	Droughty, slope, rooting depth.
Woodward	Severe: depth to rock.	Moderate: thin layer, unstable fill, compressible.	Severe: no water.	Not needed	Slope	Slope.
41*: Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, slope.	Droughty, slope, rooting depth.
Dill	Severe: seepage.	Moderate: thin layer, unstable fill, piping.	Severe: no water.	Not needed	Depth to rock	Rooting depth.
42 Reinach	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Severe: deep to water.	Not needed	Not needed	Not needed.
43 Retrop	Moderate: seepage.	Moderate: unstable fill, compressible, piping.	Moderate: deep to water.	Floods	Not needed	Wetness.
44, 45 Shellabarger	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Not needed	Too sandy, soil blowing.	Favorable.
46, 47, 48 St. Paul	Moderate: seepage.	Moderate: compressible, unstable fill, piping.	Severe: no water.	Not needed	Favorable	Favorable.
49*: Vernon	Slight	Moderate: hard to pack.	Severe: no water.	Not needed	Favorable	Droughty, percs slowly, slope.
Rock outcrop.						
50, 51, 52 Woodward	Severe: depth to rock.	Moderate: thin layer, unstable fill, compressible.	Severe: no water.	Not needed	Favorable	Favorable.
53*: Woodward	Severe: depth to rock.	Moderate: thin layer, unstable fill, compressible.	Severe: no water.	Not needed	Slope	Slope.
Clairemont	Moderate: seepage.	Slight	Severe: no water.	Not needed	Not needed	Erodes easily.
54*, 55*: Woodward	Severe: depth to rock.	Moderate: thin layer, unstable fill, compressible.	Severe: no water.	Not needed	Favorable	Favorable.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
54*, 55*:						
Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock, slope.	Droughty, slope, rooting depth.
56 Yahola	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Severe: deep to water.	Not needed	Not needed	Not needed.

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Abilene	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
2*:				
Altus	Slight	Slight	Slight	Slight.
Grandfield	Slight	Slight	Slight	Slight.
3*:				
Altus	Slight	Slight	Slight	Slight.
Grandfield	Slight	Slight	Moderate: slope.	Slight.
4 Amber	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
5, 6 Binger	Slight	Slight	Moderate: depth to rock.	Slight.
7, 8 Carey	Slight	Slight	Moderate: slope.	Slight.
9, 10 Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
11 Cordell	Moderate: percs slowly.	Moderate: too clayey.	Severe: depth to rock.	Moderate: too clayey.
12*:				
Cordell	Moderate: percs slowly.	Moderate: too clayey.	Severe: depth to rock.	Moderate: too clayey.
Rock outcrop.				
13*:				
Cornick	Severe: depth to rock.	Moderate: dusty.	Severe: depth to rock.	Moderate: dusty.
Rock outcrop.				
14, 15 Devol	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
16*, 17*:				
Devol	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Grandfield	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
18 Dill	Slight	Slight	Moderate: slope.	Slight.
19*, 20*:				
Dill	Slight	Slight	Moderate: slope.	Slight.
Quinlan	Slight	Slight	Severe: depth to rock.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
21*:				
Dill	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Quinlan	Moderate: slope.	Moderate: slope.	Severe: depth to rock.	Slight.
22 Dodson	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
23*:				
Dougherty	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Eufaula	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
24 Grandfield	Slight	Slight	Slight	Slight.
25, 26 Grandfield	Slight	Slight	Moderate: slope.	Slight.
27, 28 Hardeman	Slight	Slight	Moderate: slope.	Slight.
29 Hardeman	Slight	Slight	Severe: slope.	Slight.
30, 31, 32 Obaro	Slight	Slight	Moderate: slope.	Slight.
33 Pond Creek	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
34 Pond Creek	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
35 Port	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
36 Pratt	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
37*:				
Quinlan	Moderate: slope.	Moderate: slope.	Severe: depth to rock.	Slight.
Obaro	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
38*:				
Quinlan	Moderate: slope.	Moderate: slope.	Severe: depth to rock.	Slight.
Rock outcrop.				
39*:				
Quinlan	Slight	Slight	Severe: depth to rock.	Slight.
Woodward	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
40*:				
Quinlan	Moderate: slope.	Moderate: slope.	Severe: depth to rock.	Slight.
Woodward	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
41*:				
Quinlan	Slight	Slight	Severe: depth to rock.	Slight.
Dill	Slight	Slight	Severe: slope.	Slight.
42 Reinach	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
43 Retrop	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Moderate: floods, wetness.
44, 45 Shellabarger	Slight	Slight	Moderate: slope.	Slight.
46 St. Paul	Slight	Slight	Slight	Slight.
47, 48 St. Paul	Slight	Slight	Moderate: slope.	Slight.
49*:				
Vernon	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Rock outcrop.				
50, 51 Woodward	Slight	Slight	Moderate: slope.	Slight.
52 Woodward	Slight	Slight	Severe: slope.	Slight.
53*:				
Woodward	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
54*, 55*:				
Woodward	Slight	Slight	Moderate: slope.	Slight.
Quinlan	Slight	Slight	Severe: depth to rock.	Slight.
56 Yahola	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1: Abilene	Good	Good	Fair	---	Good	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
2*:												
Altus	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Grandfield	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
3*:												
Altus	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Grandfield	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
4: Amber	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	---	Very poor.	Good.
5: Binger	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
6: Binger	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
7: Carey	Good	Good	Fair	---	Very poor.	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
8: Carey	Fair	Good	Fair	---	Very poor.	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
9, 10: Clairemont	Good	Good	Fair	---	Very poor.	Good	Very poor.	Very poor.	Good	---	Very poor.	Fair.
11: Cordell	Poor	Poor	Fair	---	---	Very poor.	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
12*:												
Cordell	Poor	Poor	Fair	---	---	Very poor.	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Rock outcrop.												
13*:												
Cornick	Poor	Poor	Poor	---	---	Very poor.	Very poor.	Very poor.	Poor	---	Very poor.	Very poor.
Rock outcrop.												
14, 15: Devol	Fair	Fair	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
16*, 17*:												
Devol	Fair	Fair	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Grandfield	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
18: Dill	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
19*, 20*:												
Dill	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Quinlan	Poor	Poor	Fair	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
21*:												
Dill	Fair	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
Quinlan	Poor	Poor	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
22 Dodson	Good	Good	Fair	---	Very poor.	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
23*:												
Dougherty	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
Eufaula	Fair	Fair	Fair	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
24 Grandfield	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
25, 26 Grandfield	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
27, 28 Hardeman	Good	Good	Good	---	Very poor.	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
29 Hardeman	Fair	Good	Good	---	Very poor.	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
30, 31, 32 Obaro	Fair	Fair	Fair	---	Very poor.	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
33, 34 Pond Creek	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
35 Port	Good	Good	Fair	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Fair.
36 Pratt	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
37*:												
Quinlan	Poor	Poor	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Obaro	Poor	Fair	Fair	---	Very poor.	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
38*:												
Quinlan	Poor	Poor	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Rock outcrop.												
39*:												
Quinlan	Poor	Poor	Fair	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
Woodward	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
40*:												
Quinlan	Poor	Poor	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Woodward	Fair	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
41*:												
Quinlan	Poor	Poor	Fair	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
Dill	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
42 Reinach	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
43 Retrop	Poor	Fair	Fair	Good	Good	---	Good	Fair	Fair	Good	Fair	---
44 Shellabarger	Good	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
45 Shellabarger	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
46, 47, 48 St. Paul	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
49*:												
Vernon	Fair	Fair	Poor	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Rock outcrop.												
50, 51, 52 Woodward	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
53*:												
Woodward	Fair	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
Clairemont	Good	Good	Fair	---	Very poor.	Good	Very poor.	Very poor.	Good	---	Very poor.	Fair.
54*, 55*:												
Woodward	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Quinlan	Poor	Poor	Fair	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
56 Yahola	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1------------------ Abilene	0-12	Silt loam-------	CL	A-4, A-6	0	95-100	95-100	90-100	60-96	25-35	8-16
	12-53	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	95-100	95-100	90-100	75-95	34-58	22-40
	53-80	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0	90-100	88-100	80-98	60-95	35-50	19-32
2*:											
Altus-------------	0-10	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	10-16	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	16-72	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
Grandfield--------	0-8	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	8-75	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
3*:											
Altus-------------	0-7	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	7-19	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	19-75	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
Grandfield--------	0-10	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	10-75	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
4------------------ Amber	0-36	Very fine sandy loam.	CL, ML, CL-ML	A-4	0	100	100	94-100	51-75	<30	NP-9
	36-64	Very fine sandy loam, fine sandy loam, loamy fine sand.	CL, ML, SC, SM	A-2, A-4	0	100	98-100	90-100	15-75	<30	NP-9
5------------------ Binger	0-7	Fine sandy loam	SM, SM-SC	A-4, A-2	0	100	98-100	94-100	30-50	<26	NP-7
	7-28	Fine sandy loam, sandy clay loam.	SC, CL, ML, SM	A-4, A-6	0	90-100	83-100	75-100	36-65	20-35	6-15
	28-34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
6------------------ Binger	0-7	Fine sandy loam	SM, SM-SC	A-4, A-2	0	100	98-100	94-100	30-50	<26	NP-7
	7-32	Fine sandy loam, sandy clay loam.	SC, CL, ML, SM	A-4, A-6	0	90-100	83-100	75-100	36-65	20-35	6-15
	32-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
7------------------ Carey	0-10	Silt loam-------	CL, ML, CL-ML	A-4, A-6	0	100	98-100	90-100	51-90	20-32	3-15
	10-36	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	60-95	25-40	5-20
	36-54	Silt loam, loam, very fine sandy loam.	CL, ML, CL-ML, SM	A-4, A-6	0	100	90-100	85-100	44-85	20-35	3-12
8------------------ Carey	0-6	Silt loam-------	CL, ML, CL-ML	A-4, A-6	0	100	98-100	90-100	51-90	20-32	3-15
	6-36	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	60-95	25-40	5-20
	36-44	Silt loam, loam, very fine sandy loam.	CL, ML, CL-ML, SM	A-4, A-6	0	100	90-100	85-100	44-85	20-35	3-12
9------------------ Clairemont	0-62	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	51-95	25-40	7-20
10----------------- Clairemont	0-70	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	51-95	25-40	7-20
11----------------- Cordell	0-6	Silty clay loam	CL, ML	A-4, A-6	0	90-100	83-100	80-100	65-98	20-40	8-20
	6-14	Silty clay loam, silt loam, shaly silty clay loam.	CL, SC, GC	A-4, A-6	0	65-100	56-100	50-100	36-98	20-40	8-20
	14-17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
12*: Cordell-----------	0-6	Silty clay loam	CL, ML	A-4, A-6	0	90-100	83-100	80-100	65-98	20-40	8-20
	6-10	Silty clay loam, silt loam, shaly silty clay loam.	CL, SC, GC	A-4, A-6	0	65-100	56-100	50-100	36-98	20-40	8-20
	10-14	Very shaly silty clay loam, very shaly silt loam.	GC, GP-GC	A-2	0	15-50	5-35	5-35	5-35	20-40	5-20
	14-17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
13*: Cornick-----------	0-7	Silt loam-------	CL, ML	A-4, A-6	0	100	100	90-100	70-90	22-37	2-14
	7-11	Weathered bedrock.	---	---	---	---	---	---	---	---	---
	11-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
14----------------- Devol	0-12	Loamy fine sand	SM	A-2	0	98-100	98-100	90-100	15-35	---	NP
	12-36	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	98-100	98-100	94-100	36-60	<26	NP-7
	36-64	Loamy fine sand, loamy sand, fine sand.	SM	A-2, A-4	0	98-100	98-100	50-100	15-50	<26	NP-3
15----------------- Devol	0-15	Loamy fine sand	SM	A-2	0	98-100	98-100	90-100	15-35	---	NP
	15-42	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	98-100	98-100	94-100	36-60	<26	NP-7
	42-60	Loamy fine sand, loamy sand, fine sand.	SM	A-2, A-4	0	98-100	98-100	50-100	15-50	<26	NP-3

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
16*:											
Devol	0-18	Loamy fine sand	SM	A-2	0	98-100	98-100	90-100	15-35	---	NP
	18-50	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	98-100	98-100	94-100	36-60	<26	NP-7
	50-64	Loamy fine sand, loamy sand, fine sand.	SM	A-2, A-4	0	98-100	98-100	50-100	15-50	<26	NP-3
Grandfield	0-12	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	12-64	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
17*:											
Devol	0-16	Loamy fine sand	SM	A-2	0	98-100	98-100	90-100	15-35	---	NP
	16-46	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0	98-100	98-100	94-100	36-60	<26	NP-7
	46-72	Loamy fine sand, loamy sand, fine sand.	SM	A-2, A-4	0	98-100	98-100	50-100	15-50	<26	NP-3
Grandfield	0-12	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	12-62	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
18 Dill	0-14	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	100	90-100	36-60	<26	NP-6
	14-33	Fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	98-100	95-100	90-100	36-60	<26	NP-6
	33-47	Weathered bedrock.	---	---	---	---	---	---	---	---	---
19*:											
Dill	0-10	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	100	90-100	36-65	<26	NP-6
	10-34	Fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	98-100	95-100	90-100	36-65	<26	NP-6
	34-38	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Quinlan	0-14	Fine sandy loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	14-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---
20*:											
Dill	0-8	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	100	90-100	36-60	<26	NP-6
	8-32	Fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	98-100	95-100	90-100	36-60	<26	NP-6
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Quinlan	0-14	Fine sandy loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	14-18	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
21*:											
Dill	0-7	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	100	90-100	36-60	<26	NP-6
	7-28	Fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	98-100	95-100	90-100	36-60	<26	NP-6
	28-35	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Quinlan	0-19	Fine sandy loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	19-22	Weathered bedrock.	---	---	---	---	---	---	---	---	---
22 Dodson	0-19	Silt loam	CL, CL-ML	A-4, A-6	0	100	98-100	90-100	70-95	22-35	5-15
	19-70	Silty clay loam, clay loam, silty clay.	CL	A-6, A-7	0	98-100	95-100	90-100	65-95	28-45	11-28
	70-80	Silty clay loam, silt loam, loam.	CL, CL-ML	A-4, A-6, A-7	0	90-100	90-100	85-100	60-90	25-45	6-23
23*:											
Dougherty	0-26	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	26-42	Fine sandy loam, sandy clay loam.	ML, SM, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
	42-51	Fine sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
	51-70	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
Eufaula	0-72	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
24 Grandfield	0-12	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-72	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
25 Grandfield	0-10	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	10-72	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
26 Grandfield	0-7	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	7-72	Fine sandy loam, sandy clay loam.	SM, SC, CL, ML	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
27 Hardeman	0-14	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4, A-2-4	0	100	98-100	70-95	30-75	18-27	2-9
	14-60	Fine sandy loam, loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	0	100	98-100	70-95	30-70	18-25	2-7
28 Hardeman	0-14	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4, A-2-4	0	100	98-100	70-95	30-75	18-27	2-9
	14-72	Fine sandy loam, loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	0	100	98-100	70-95	30-70	18-25	2-7

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
29 Hardeman	0-13	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4, A-2-4	0	100	98-100	70-95	30-75	18-27	2-9
	13-69	Fine sandy loam, loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	0	100	98-100	70-95	30-70	18-25	2-7
30 Obaro	0-38	Silty clay loam	CL, CL-ML, ML	A-4, A-6	0	98-100	95-100	95-100	80-98	25-40	7-20
	38-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
31 Obaro	0-31	Silty clay loam	CL, CL-ML, ML	A-4, A-6	0	98-100	95-100	95-100	80-98	25-40	7-20
	31-34	Weathered bedrock.	---	---	---	---	---	---	---	---	---
32 Obaro	0-36	Silty clay loam	CL, CL-ML, ML	A-4, A-6	0	98-100	95-100	95-100	80-98	25-40	7-20
	36-50	Weathered bedrock.	---	---	---	---	---	---	---	---	---
33 Pond Creek	0-10	Fine sandy loam	SM, SC, CL, ML	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	10-78	Silty clay loam, clay loam, silt loam.	CL, ML	A-4, A-6, A-7	0	100	100	96-100	65-98	30-43	8-20
34 Pond Creek	0-10	Fine sandy loam	SM, SC, CL, ML	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	10-72	Silty clay loam, clay loam, silt loam.	CL, ML	A-4, A-6, A-7	0	100	100	96-100	65-98	30-43	8-20
35 Port	0-22	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	96-100	80-98	27-43	8-20
	22-60	Silty clay loam, clay loam, loam.	ML, CL	A-4, A-6, A-7	0	100	100	96-100	65-98	27-43	8-20
36 Pratt	0-10	Loamy fine sand	SM	A-2	0	100	95-100	70-100	15-35	---	NP
	10-18	Loamy fine sand, loamy sand, fine sandy loam.	SM, SM-SC	A-2, A-4	0	100	95-100	90-100	15-40	<20	NP-6
	18-72	Loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	95-100	80-100	5-35	---	NP
37*:											
Quinlan	0-17	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	17-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Obaro	0-33	Silty clay loam	CL, CL-ML, ML	A-4, A-6	0	98-100	95-100	95-100	80-98	25-40	7-20
	33-37	Weathered bedrock.	---	---	---	---	---	---	---	---	---
38*:											
Quinlan	0-15	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	15-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
38*: Rock outcrop.											
39*: Quinlan-----------	0-14	Loam------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	14-22	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Woodward----------	0-24	Loam------------	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	<31	NP-10
	24-27	Weathered bedrock.	---	---	---	---	---	---	---	---	---
40*: Quinlan-----------	0-19	Loam------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	19-24	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Woodward----------	0-32	Loam------------	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	<31	NP-10
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
41*: Quinlan-----------	0-16	Fine sandy loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	16-20	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Dill--------------	0-5	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	100	90-100	36-60	<26	NP-6
	5-27	Fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4	0	98-100	95-100	90-100	36-60	<26	NP-6
	27-33	Weathered bedrock.	---	---	---	---	---	---	---	---	---
42---------------- Reinach	0-74	Silt loam-------	CL, ML	A-4	0	100	100	94-100	51-97	<31	NP-10
43---------------- Retrop	0-7	Silty clay loam	CL, ML	A-4, A-6, A-7	0	100	100	96-100	65-98	30-42	9-19
	7-64	Stratified silt loam to silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	96-100	65-98	30-42	9-19
44---------------- Shellabarger	0-11	Fine sandy loam	SM, ML	A-4, A-2	0	95-100	95-100	75-100	30-55	<30	NP-5
	11-48	Sandy clay loam, sandy loam, fine sandy loam.	SC	A-4, A-6	0	95-100	95-100	70-90	35-50	25-40	8-20
	48-75	Coarse sandy loam, fine sandy loam, sand.	SC, SM, SP-SM, SM-SC	A-2, A-4	0	70-100	70-100	50-80	10-40	<30	NP-10
45---------------- Shellabarger	0-13	Fine sandy loam	SM, ML	A-4, A-2	0	95-100	95-100	75-100	30-55	<30	NP-5
	13-53	Sandy clay loam, sandy loam, fine sandy loam.	SC	A-4, A-6	0	95-100	95-100	70-90	35-50	25-40	8-20
	53-75	Coarse sandy loam, fine sandy loam, sand.	SC, SM, SP-SM, SM-SC	A-2, A-4	0	70-100	70-100	50-80	10-40	<30	NP-10

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
46---------------- St. Paul	0-16	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	76-98	21-35	2-13
	16-21	Silt loam, loam, silty clay loam.	CL	A-4, A-6	0	100	100	95-100	75-98	27-40	8-18
	21-42	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	74-98	33-43	12-20
	42-60	Silt loam, loam, silty clay loam.	CL, CH	A-6, A-7	0	100	95-100	95-100	72-98	30-55	11-30
47---------------- St. Paul	0-8	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	76-98	21-35	2-13
	8-13	Silt loam, loam, silty clay loam.	CL	A-4, A-6	0	100	100	95-100	75-98	27-40	8-18
	13-50	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	74-98	33-43	12-20
	50-60	Silt loam, loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	95-100	72-98	30-55	11-30
48---------------- St. Paul	0-6	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	76-98	21-35	2-13
	6-10	Silt loam, loam, silty clay loam.	CL	A-4, A-6	0	100	100	95-100	75-98	27-40	8-18
	10-42	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	74-98	33-43	12-20
	42-64	Silt loam, loam, clay loam.	CL, CH	A-6, A-7	0	100	95-100	95-100	72-98	30-55	11-30
	64-70	Silt loam, loam, clay loam.	CL	A-4, A-6, A-7	0	100	95-100	94-100	70-96	27-45	8-22
49*:											
Vernon------------	0-6	Clay loam-------	CL	A-6, A-7-6	0	95-100	90-100	90-100	70-95	35-50	17-30
	6-26	Clay------------	CL, CH	A-6, A-7-6	0	95-100	90-100	90-100	80-98	38-60	20-38
	26-43	Shaly clay------	CL, CH	A-6, A-7-6	0-5	90-100	85-100	65-100	65-95	30-60	15-38
Rock outcrop.											
50---------------- Woodward	0-36	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	<31	NP-10
	36-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
51---------------- Woodward	0-38	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	<31	NP-10
	38-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
52---------------- Woodward	0-36	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	<31	NP-10
	36-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
53*:											
Woodward----------	0-32	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	<31	NP-10
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
53*:											
Clairemont	0-64	Silt loam	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	51-95	25-40	7-20
54*, 55*:											
Woodward	0-32	Loam	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	<31	NP-10
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Quinlan	0-15	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	15-24	Weathered bedrock.	---	---	---	---	---	---	---	---	---
56 Yahola	0-6	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	6-11	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	11-72	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A-4, A-2	0	100	95-100	90-100	15-85	<30	NP-10

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
1 Abilene	0-12	0.6-2.0	0.15-0.20	6.6-8.4	<2	Moderate	High	Low	0.37	5	---
	12-53	0.2-0.6	0.14-0.18	6.6-8.4	<2	Moderate	High	Low	0.28		
	53-80	0.2-0.6	0.12-0.15	7.9-8.4	<2	Moderate	High	Low	0.32		
2*:											
Altus	0-10	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low	Low	Low	0.24	5	3
	10-16	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.24		
	16-72	0.6-2.0	0.11-0.17	6.6-8.4	<2	Low	Low	Low	0.32		
Grandfield	0-8	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.24	5	3
	8-75	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low	Moderate	Low	0.32		
3*:											
Altus	0-7	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low	Low	Low	0.24	5	3
	7-19	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.24		
	19-75	0.6-2.0	0.11-0.17	6.6-8.4	<2	Low	Low	Low	0.32		
Grandfield	0-10	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.24	5	3
	10-75	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low	Moderate	Low	0.32		
4 Amber	0-36	0.6-2.0	0.13-0.20	6.1-8.4	<2	Low	Low	Low	0.37	5	---
	36-64	0.6-2.0	0.07-0.20	7.9-8.4	<2	Low	Low	Low	0.37		
5 Binger	0-7	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.24	3	3
	7-28	0.6-2.0	0.12-0.17	6.1-7.8	<2	Low	Moderate	Low	0.32		
	28-34	---	---	---	---	---	---	---	---		
6 Binger	0-7	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.24	3	3
	7-32	0.6-2.0	0.12-0.17	6.1-7.8	<2	Low	Moderate	Low	0.32		
	32-60	---	---	---	---	---	---	---	---		
7 Carey	0-10	0.6-2.0	0.15-0.20	6.6-7.8	<2	Low	Low	Low	0.43	5	6
	10-36	0.6-2.0	0.15-0.20	6.6-8.4	<2	Low	Moderate	Low	0.43		
	36-54	0.6-2.0	0.10-0.18	7.9-8.4	<2	Low	Moderate	Low	0.43		
8 Carey	0-6	0.6-2.0	0.15-0.20	6.6-7.8	<2	Low	Low	Low	0.43	5	6
	6-36	0.6-2.0	0.15-0.20	6.6-8.4	<2	Low	Moderate	Low	0.43		
	36-44	0.6-2.0	0.10-0.18	7.9-8.4	<2	Low	Moderate	Low	0.43		
9 Clairemont	0-62	0.6-2.0	0.16-0.22	7.9-8.4	<2	Low	Moderate	Low	0.43	5	6
10 Clairemont	0-70	0.6-2.0	0.16-0.22	7.9-8.4	<2	Low	Moderate	Low	0.43	5	6
11 Cordell	0-6	0.2-0.6	0.16-0.24	7.4-8.4	<2	Low	Moderate	Low	0.32	1	---
	6-14	0.2-0.6	0.15-0.22	7.4-8.4	<2	Low	Moderate	Low	0.32		
	14-17	---	---	---	---	---	---	---	---		
12*:											
Cordell	0-6	0.2-0.6	0.16-0.24	7.4-8.4	<2	Low	Moderate	Low	0.32	1	---
	6-10	0.2-0.6	0.15-0.22	7.4-8.4	<2	Low	Moderate	Low	0.32		
	10-14	0.2-0.6	0.08-0.12	7.4-8.4	<2	Low	Moderate	Low	0.28		
	14-17	---	---	---	---	---	---	---	---		
Rock outcrop.											
13*:											
Cornick	0-7	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low	High	Moderate	0.37	1	6
	7-11	---	---	---	---	---	---	---	---		
	11-18	---	---	---	---	---	---	---	---		
Rock outcrop.											

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
14	0-12	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low	Low	Low	0.15	5	2
Devol	12-36	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.20		
	36-72	2.0-6.0	0.08-0.12	6.6-8.4	<2	Low	Low	Low	0.17		
15	0-15	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low	Low	Low	0.15	5	2
Devol	15-42	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.20		
	42-60	2.0-6.0	0.08-0.12	6.6-8.4	<2	Low	Low	Low	0.17		
16*:											
Devol	0-18	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low	Low	Low	0.15	5	2
	18-50	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.20		
	50-64	2.0-6.0	0.08-0.12	6.6-8.4	<2	Low	Low	Low	0.17		
Grandfield	0-12	2.0-6.0	0.07-0.11	6.1-7.8	<2	Low	Low	Low	0.20	5	2
	12-64	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low	Moderate	Low	0.32		
17*:											
Devol	0-16	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low	Low	Low	0.15	5	2
	16-46	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	Low	Low	0.20		
	46-72	2.0-6.0	0.08-0.12	6.6-8.4	<2	Low	Low	Low	0.17		
Grandfield	0-12	2.0-6.0	0.07-0.11	6.1-7.8	<2	Low	Low	Low	0.20	5	2
	12-62	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low	Moderate	Low	0.32		
18	0-14	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32	3	2
Dill	14-33	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32		
	33-47	---	---	---	---	---	---	---	---		
19*:											
Dill	0-10	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32	3	2
	10-34	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32		
	34-38	---	---	---	---	---	---	---	---		
Quinlan	0-14	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low	Low	Low	0.32	2	5
	14-20	---	---	---	---	---	---	---	---		
20*:											
Dill	0-8	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32	3	2
	8-32	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32		
	32-40	---	---	---	---	---	---	---	---		
Quinlan	0-14	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low	Low	Low	0.32	2	5
	14-18	---	---	---	---	---	---	---	---		
21*:											
Dill	0-7	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32	3	2
	7-28	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32		
	28-35	---	---	---	---	---	---	---	---		
Quinlan	0-19	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low	Low	Low	0.32	2	5
	19-22	---	---	---	---	---	---	---	---		
22	0-19	0.6-2.0	0.15-0.20	6.6-7.8	<2	Low	Moderate	Low	0.32	5	6
Dodson	19-70	0.2-0.6	0.14-0.20	6.6-8.4	<2	Moderate	Moderate	Low	0.32		
	70-80	0.2-0.6	0.12-0.16	7.9-8.4	<2	Moderate	Moderate	Low	0.32		
23*:											
Dougherty	0-26	2.0-6.0	0.07-0.11	5.1-6.5	<2	Low	Low	Moderate	0.20	5	2
	26-42	0.6-2.0	0.11-0.17	5.1-6.5	<2	Low	Low	Moderate	0.32		
	42-51	0.6-2.0	0.11-0.17	5.1-7.3	<2	Low	Low	Moderate	0.32		
	51-70	2.0-6.0	0.07-0.11	5.1-7.3	<2	Low	Low	Moderate	0.24		
Eufaula	0-72	6.0-20.0	0.05-0.11	5.1-7.3	<2	Low	Low	Moderate	0.17	5	1
24	0-12	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.24	5	3
Grandfield	12-72	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low	Moderate	Low	0.32		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi-bility group
	In	In/hr	In/in	pH	Mmhos/cm						
25---------------- Grandfield	0-10	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low--------	Low-------	Low-------	0.24	5	3
	10-72	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low--------	Moderate	Low-------	0.32		
26---------------- Grandfield	0-7	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low--------	Low-------	Low-------	0.24	5	3
	7-72	0.6-2.0	0.11-0.17	6.1-8.4	<2	Low--------	Moderate	Low-------	0.32		
27---------------- Hardeman	0-14	2.0-6.0	0.10-0.18	7.4-8.4	<2	Very low	Low-------	Low-------	0.28	5	3
	14-60	2.0-6.0	0.10-0.15	7.4-8.4	<2	Very low	Low-------	Low-------	0.28		
28---------------- Hardeman	0-14	2.0-6.0	0.10-0.18	7.4-8.4	<2	Very low	Low-------	Low-------	0.28	5	3
	14-72	2.0-6.0	0.10-0.15	7.4-8.4	<2	Very low	Low-------	Low-------	0.28		
29---------------- Hardeman	0-13	2.0-6.0	0.10-0.18	7.4-8.4	<2	Very low	Low-------	Low-------	0.28	5	3
	13-69	2.0-6.0	0.10-0.15	7.4-8.4	<2	Very low	Low-------	Low-------	0.28		
30---------------- Obaro	0-38	0.6-2.0	0.14-0.20	7.9-8.4	<2	Low--------	Low-------	Low-------	0.43	3	4L
	38-40	---	---	---	---	----------	----------	----------	---		
31---------------- Obaro	0-31	0.6-2.0	0.14-0.20	7.9-8.4	<2	Low--------	Low-------	Low-------	0.43	3	4L
	31-34	---	---	---	---	----------	----------	----------	---		
32---------------- Obaro	0-36	0.6-2.0	0.14-0.20	7.9-8.4	<2	Low--------	Low-------	Low-------	0.43	3	4L
	36-50	---	---	---	---	----------	----------	----------	---		
33---------------- Pond Creek	0-10	2.0-6.0	0.11-0.15	5.6-7.3	<2	Low--------	Low-------	Low-------	0.24	5	---
	10-78	0.2-0.6	0.15-0.22	6.1-8.4	<2	Moderate	Moderate	Moderate	0.37		
34---------------- Pond Creek	0-10	2.0-6.0	0.11-0.15	5.6-7.3	<2	Low--------	Low-------	Low-------	0.24	5	---
	10-72	0.2-0.6	0.15-0.22	6.1-8.4	<2	Moderate	Moderate	Moderate	0.37		
35---------------- Port	0-22	0.6-2.0	0.15-0.24	5.6-7.8	<2	Moderate	Moderate	Low-------	0.37	5	---
	22-60	0.6-2.0	0.15-0.24	6.1-8.4	<2	Moderate	Moderate	Low-------	0.37		
36---------------- Pratt	0-10	6.0-20	0.10-0.13	5.6-7.3	<2	Low--------	Low-------	Moderate	0.17	5	2
	10-18	6.0-20	0.09-0.16	5.6-7.3	<2	Low--------	Low-------	Low-------	0.17		
	18-72	6.0-20	0.08-0.12	6.1-7.3	<2	Low--------	Low-------	Low-------	0.17		
37*:											
Quinlan-----------	0-17	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low--------	Low-------	Low-------	0.32	2	5
	17-20	---	---	---	---	----------	----------	----------	---		
Obaro-------------	0-33	0.6-2.0	0.14-0.20	7.9-8.4	<2	Low--------	Low-------	Low-------	0.43	3	4L
	33-37	---	---	---	---	----------	----------	----------	---		
38*:											
Quinlan-----------	0-15	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low--------	Low-------	Low-------	0.32	2	5
	15-20	---	---	---	---	----------	----------	----------	---		
Rock outcrop.											
39*:											
Quinlan-----------	0-14	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low--------	Low-------	Low-------	0.32	2	5
	14-22	---	---	---	---	----------	----------	----------	---		
Woodward----------	0-24	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low--------	Low-------	Low-------	0.37	3	5
	24-27	---	---	---	---	----------	----------	----------	---		
40*:											
Quinlan-----------	0-19	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low--------	Low-------	Low-------	0.32	2	5
	19-24	---	---	---	---	----------	----------	----------	---		
Woodward----------	0-32	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low--------	Low-------	Low-------	0.37	3	5
	32-40	---	---	---	---	----------	----------	----------	---		
41*:											
Quinlan-----------	0-16	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low--------	Low-------	Low-------	0.32	2	5
	16-20	---	---	---	---	----------	----------	----------	---		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
41*:											
Dill	0-5	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32	2	2
	5-27	2.0-6.0	0.11-0.15	6.1-7.8	<2	Low	Low	Low	0.32		
	27-33	---	---	---	---	---	---	---	---		
42 Reinach	0-74	0.6-2.0	0.13-0.24	6.1-8.4	<2	Low	Low	Low	0.37	5	---
43 Retrop	0-7	0.6-2.0	0.15-0.22	7.9-8.4	<2	Moderate	High	Low	0.37	5	---
	7-64	0.6-2.0	0.15-0.22	7.9-8.4	<2	Moderate	High	Low	0.37		
44 Shellabarger	0-11	0.6-2.0	0.13-0.21	5.6-6.5	<2	Low	Low	Moderate	0.20	5	3
	11-48	0.6-2.0	0.16-0.18	6.1-7.3	<2	Low	Low	Moderate	0.28		
	48-75	0.6-20	0.05-0.16	6.1-8.4	<2	Low	Low	Low	0.28		
45 Shellabarger	0-13	0.6-2.0	0.13-0.21	5.6-6.5	<2	Low	Low	Moderate	0.20	5	3
	13-53	0.6-2.0	0.16-0.18	6.1-7.3	<2	Low	Low	Moderate	0.28		
	53-75	0.6-20	0.05-0.16	6.1-8.4	<2	Low	Low	Low	0.28		
46 St. Paul	0-16	0.6-2.0	0.17-0.21	6.6-7.8	<2	Low	Low	Low	0.37	5	6
	16-21	0.6-2.0	0.17-0.21	6.6-7.8	<2	Low	Moderate	Low	0.37		
	21-42	0.2-0.6	0.17-0.21	7.4-8.4	<2	Moderate	Moderate	Low	0.32		
	42-60	0.2-0.6	0.17-0.21	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
47 St. Paul	0-8	0.6-2.0	0.17-0.21	6.6-7.8	<2	Low	Low	Low	0.37	5	6
	8-13	0.6-2.0	0.17-0.21	6.6-7.8	<2	Low	Moderate	Low	0.37		
	13-50	0.2-0.6	0.17-0.21	7.4-8.4	<2	Moderate	Moderate	Low	0.32		
	50-60	0.2-0.6	0.17-0.21	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
48 St. Paul	0-6	0.6-2.0	0.17-0.21	6.6-7.8	<2	Low	Low	Low	0.37	5	6
	6-10	0.6-2.0	0.17-0.21	6.6-7.8	<2	Low	Moderate	Low	0.37		
	10-42	0.2-0.6	0.17-0.21	7.4-8.4	<2	Moderate	Moderate	Low	0.32		
	42-64	0.2-0.6	0.17-0.21	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
	64-70	0.6-2.0	0.17-0.21	7.9-8.4	<2	Low	Moderate	Low	0.37		
49*:											
Vernon	0-6	0.06-0.2	0.12-0.17	7.9-8.4	<2	High	High	Low	0.32	2	6
	6-26	<0.06	0.10-0.15	7.9-8.4	<2	High	High	Low	0.32		
	26-43	<0.06	0.-0.10	7.9-8.4	<2	High	High	Low	0.32		
Rock outcrop.											
50 Woodward	0-36	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low	Low	Low	0.37	3	5
	36-40	---	---	---	---	---	---	---	---		
51 Woodward	0-38	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low	Low	Low	0.37	3	5
	38-40	---	---	---	---	---	---	---	---		
52 Woodward	0-36	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low	Low	Low	0.37	3	5
	36-40	---	---	---	---	---	---	---	---		
53*:											
Woodward	0-32	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low	Low	Low	0.37	3	5
	32-40	---	---	---	---	---	---	---	---		
Clairemont	0-64	0.6-2.0	0.16-0.22	7.9-8.4	<2	Low	Moderate	Low	0.43	5	6
54*, 55*:											
Woodward	0-32	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low	Low	Low	0.37	3	5
	32-40	---	---	---	---	---	---	---	---		
Quinlan	0-15	2.0-6.0	0.15-0.20	7.4-8.4	<2	Low	Low	Low	0.32	2	5
	15-24	---	---	---	---	---	---	---	---		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodi-bility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
56------------------ Yahola	0-6	2.0-6.0	0.12-0.16	7.4-8.4	<2	Low--------	Low------	Low------	0.32	5	3
	6-11	2.0-6.0	0.12-0.16	7.9-8.4	<2	Low--------	Low------	Low------	0.32		
	11-72	2.0-6.0	0.07-0.16	7.9-8.4	<2	Low--------	Low------	Low------	0.32		

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," and "apparent." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
1------------------ Abilene	C	None---------	---	---	>6.0	---	---	>60	---
2*, 3*:									
Altus------------	B	None---------	---	---	>6.0	---	---	>60	---
Grandfield-------	B	None---------	---	---	>6.0	---	---	>60	---
4------------------ Amber	B	Rare---------	Very brief	Mar-Aug	>6.0	---	---	>60	---
5, 6-------------- Binger	B	None---------	---	---	>6.0	---	---	20-40	Rippable
7, 8-------------- Carey	B	None---------	---	---	>6.0	---	---	>60	---
9, 10------------- Clairemont	B	Common-------	Very brief	Apr-Nov	>6.0	---	---	>60	---
11---------------- Cordell	D	None---------	---	---	>6.0	---	---	10-20	Hard
12*:									
Cordell----------	D	None---------	---	---	>6.0	---	---	10-20	Hard
Rock outcrop.									
13*:									
Cornick----------	D	None---------	---	---	>6.0	---	---	4-10	Rippable
Rock outcrop.									
14, 15------------ Devol	B	None---------	---	---	>6.0	---	---	>60	---
16*, 17*:									
Devol------------	B	None---------	---	---	>6.0	---	---	>60	---
Grandfield-------	B	None---------	---	---	>6.0	---	---	>60	---
18---------------- Dill	B	None---------	---	---	>6.0	---	---	20-40	Rippable
19*, 20*, 21*:									
Dill-------------	B	None---------	---	---	>6.0	---	---	20-40	Rippable
Quinlan----------	C	None---------	---	---	>6.0	---	---	10-20	Rippable
22---------------- Dodson	C	None---------	---	---	>6.0	---	---	>60	---
23*:									
Dougherty--------	A	None---------	---	---	>6.0	---	---	>60	---
Eufaula----------	A	None---------	---	---	>6.0	---	---	>60	---
24, 25, 26-------- Grandfield	B	None---------	---	---	>6.0	---	---	>60	---
27, 28, 29-------- Hardeman	B	None---------	---	---	>6.0	---	---	>60	---

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
30, 31, 32-------- Obaro	B	None--------	---	---	>6.0	---	---	20-40	Rippable
33, 34------------ Pond Creek	B	None--------	---	---	>6.0	---	---	>60	---
35---------------- Port	B	Occasional--	Very brief to brief.	Mar-Aug	>6.0	---	---	>60	---
36---------------- Pratt	A	None--------	---	---	>6.0	---	---	>60	---
37*:									
Quinlan----------	C	None--------	---	---	>6.0	---	---	10-20	Rippable
Obaro------------	B	None--------	---	---	>6.0	---	---	20-40	Rippable
38*:									
Quinlan----------	C	None--------	---	---	>6.0	---	---	10-20	Rippable
Rock outcrop.									
39*, 40*:									
Quinlan----------	C	None--------	---	---	>6.0	---	---	10-20	Rippable
Woodward---------	B	None--------	---	---	>6.0	---	---	20-40	Rippable
41*:									
Quinlan----------	C	None--------	---	---	>6.0	---	---	10-20	Rippable
Dill-------------	B	None--------	---	---	>6.0	---	---	20-40	Rippable
42---------------- Reinach	B	Rare--------	Very brief	Mar-Aug	>6.0	---	---	>60	---
43---------------- Retrop	C	Frequent----	Very brief	Apr-Oct	0.0-3.5	Apparent	Nov-May	>60	---
44, 45------------ Shellabarger	B	None--------	---	---	>6.0	---	---	>60	---
46, 47, 48-------- St. Paul	B	None--------	---	---	>6.0	---	---	>60	---
49*:									
Vernon-----------	D	None--------	---	---	>6.0	---	---	>60	---
Rock outcrop.									
50, 51, 52-------- Woodward	B	None--------	---	---	>6.0	---	---	20-40	Rippable
53*:									
Woodward---------	B	None--------	---	---	>6.0	---	---	20-40	Rippable
Clairemont-------	B	Frequent----	Very brief	Apr-Nov	>6.0	---	---	>60	---
54*, 55*:									
Woodward---------	B	None--------	---	---	>6.0	---	---	20-40	Rippable
Quinlan----------	C	None--------	---	---	>6.0	---	---	10-20	Rippable
56---------------- Yahola	B	Occasional--	Very brief	Mar-Aug	>6.0	---	---	>60	---

* See map unit description for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL ANALYSES OF SELECTED SOILS

Soil series and sample number	Depth	Horizon	Particle size distribution					
			Very coarse sand (2.0-0.25 mm)	Fine sand (0.25-0.10 mm)	Very fine sand (0.10-0.05 mm)	Total sand (2.0-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)
	In		Pct	Pct	Pct	Pct	Pct	Pct
Cordell:								
75-OK-75-5-1	0-7	A	0.3	0.7	5.0	6.0	76.0	18.0
75-OK-75-5-2	7-11	B21	0.4	0.6	4.0	5.0	76.0	19.0
75-OK-75-5-3	11-15	B22	0.6	1.0	4.4	6.0	84.0	10.0
75-OK-75-5-4	15-25	R	1.0	9.8	7.2	18.0	71.0	11.0
Dill:								
75-OK-75-4-1	0-4	A11	7.1	15.6	34.3	57.0	30.0	13.0
75-OK-75-4-2	4-14	A12	7.1	15.5	33.4	56.0	29.0	15.0
75-OK-75-4-3	14-21	B21	7.1	15.2	33.7	56.0	27.0	17.0
75-OK-75-4-4	21-33	B22	6.9	13.0	34.1	54.0	29.0	17.0
75-OK-75-4-5	33-47	Cr	3.1	2.3	46.6	52.0	36.0	12.0
Grandfield:								
75-OK-75-2-1	0-7	Ap	11.2	18.4	42.4	72.0	16.0	12.0
75-OK-75-2-2	7-13	B1	9.5	18.7	39.8	68.0	14.0	18.0
75-OK-75-2-3	13-30	B21t	3.6	19.6	41.8	65.0	17.0	18.0
75-OK-75-2-4	30-48	B22t	12.3	19.0	44.7	76.0	8.0	16.0
75-OK-75-2-5	48-61	B23t	13.6	20.7	47.7	82.0	8.0	10.0
75-OK-75-2-6	61-80	B3	14.7	18.7	53.6	87.0	8.0	5.0
Quinlan:								
75-OK-75-3-1	0-9	A	10.9	22.5	16.6	50.0	39.0	11.0
75-OK-75-3-2	9-17	B2	4.2	30.8	8.0	43.0	51.0	6.0
75-OK-75-3-3	17-25	Cr	0.3	22.4	0.3	23.0	71.0	6.0
Woodward:								
75-OK-75-1-1	0-14	A	2.2	4.9	32.9	40.0	44.0	16.0
75-OK-75-1-2	14-29	B2	1.1	2.1	28.8	32.0	52.0	16.0
75-OK-75-1-3	29-35	B3	0.5	0.7	20.8	22.0	63.0	15.0
75-OK-75-1-4	35-45	Cr	0.4	0.1	13.3	14.0	68.0	18.0

TABLE 17.--CHEMICAL ANALYSES OF SELECTED SOILS

Soil series and sample number	Depth	Horizon	Extractable bases (Milliequivalents per 100 grams of soil)				Cation exchange capacity	Base saturation	Reaction 1:1 soil:water
			Ca	Mg	K	Na			
	In							Pct	pH
Cordell:									
75-OK-75-5-1	0-7	A	29.11	5.54	0.64	0.09	19.0	83.3	8.3
75-OK-75-5-2	7-11	B21	36.75	5.38	0.44	0.09	18.6	89.3	8.3
75-OK-75-5-3	11-15	B22	36.46	6.01	0.33	0.17	15.7	90.4	8.4
75-OK-75-5-4	15-25	R	34.10	6.97	0.30	0.17	11.7	91.3	8.4
Dill:									
75-OK-75-4-1	0-4	A11	7.98	3.44	0.59	0.09	14.7	87.6	6.8
75-OK-75-4-2	4-14	A12	7.10	2.94	0.38	0.09	12.9	92.5	6.8
75-OK-75-4-3	14-21	B21	8.11	3.78	0.21	0.09	14.4	93.5	6.9
75-OK-75-4-4	21-33	B22	8.27	4.03	0.21	0.09	14.7	91.7	7.3
75-OK-75-4-5	33-47	Cr	29.06	5.04	0.13	0.09	12.6	100.0	8.4
Grandfield:									
75-OK-75-2-1	0-7	Ap	5.67	1.64	0.41	0.11	9.5	87.3	7.3
75-OK-75-2-2	7-13	B1	6.93	2.73	0.43	0.09	13.4	87.7	7.2
75-OK-75-2-3	13-30	B21t	6.85	3.78	0.23	0.11	14.2	77.8	5.9
75-OK-75-2-4	30-48	B22t	5.04	3.11	0.17	0.13	10.8	83.2	6.1
75-OK-75-2-5	48-61	B23t	3.02	2.35	0.15	0.15	6.7	86.9	6.4
75-OK-75-2-6	61-80	B3	1.85	1.22	0.09	0.13	3.7	85.3	6.8
Quinlan:									
75-OK-75-3-1	0-9	A	27.55	3.40	0.33	0.09	10.3	93.2	8.2
75-OK-75-3-2	9-17	B2	31.29	3.23	0.21	0.09	8.0	100.0	8.3
75-OK-75-3-3	17-25	Cr	29.90	3.61	0.15	0.09	6.4	96.7	8.6
Woodward:									
75-OK-75-1-1	0-14	A	14.07	3.82	0.42	0.09	9.4	78.2	8.0
75-OK-75-1-2	14-29	B2	32.72	4.28	0.23	0.09	6.8	97.0	8.5
75-OK-75-1-3	29-35	B3	31.54	4.79	0.19	0.09	5.7	97.0	8.4
75-OK-75-1-4	35-45	Cr	28.98	6.17	0.19	0.09	5.0	92.6	8.5

TABLE 18.--ENGINEERING TEST DATA

[Tests performed by Oklahoma Department of Highways, Materials Division]

Soil name and location	Parent material	Depth from surface	Shrinkage limit	Shrinkage ratio	Volume change	Mechanical analysis: Percentage passing sieve No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Percentage smaller than 0.05 mm	0.005 mm	0.002 mm	Liquid limit	Plasticity index
		In		Pct									
Binger: about 1,520 feet east and 215 feet south of the NW corner of sec. 17, T. 8 N., R. 14 W. undulating 1 percent slope.	Sandstone	0-7	18	1.75	3	100	99	32	23	12	11	20	7
		7-24	15	1.81	20	100	100	50	37	22	20	33	15
		24-28	17	1.77	5	100	99	41	31	15	12	26	6
		28-34	NP	NP	NP	100	100	37	26	11	9	NP	NP
Dill: about 4,000 feet west and 600 feet south of the NE corner of sec. 21 T. 11 N., R. 19 W. west facing 7.2 percent slope in native range.	Sandstone or packsand	0-14	16	1.75	10	100	99	60	35	14	12	23	3
		14-21	16	1.75	12	100	99	64	33	16	14	25	4
		33-47	NP	NP	NP	100	100	86	61	14	9	NP	NP
Grandfield: about 2,500 feet south and 200 feet east of the NW corner of sec. 34, T. 10 N., R. 18 W. undulating 1 percent slope.	Loamy materials	0-7	16	1.77	6	100	98	32	20	15	21	20	2
		13-30	16	1.78	13	100	100	45	36	22	20	27	8
		30-48	16	1.76	8	100	99	32	27	21	19	22	2
		61-80	NP	NP	NP	100	99	29	17	11	10	NP	NP
Obaro: about 1,200 feet south and 300 feet east of the NW corner of sec. 23, T. 11 N., R. 17 W. east side of U.S. 183; 4 percent slope.	Shale	0-7	15	1.82	22	100	100	98	93	33	26	32	12
		7-21	12	1.95	42	100	100	98	95	43	36	41	20
		21-36	13	1.93	39	100	90	96	94	45	35	42	20
		36-42	23	1.61	11	100	98	94	85	29	20	32	10
Quinlan: about 1,600 feet south and 400 feet east of the NW corner of sec. 18, T. 9 N., R. 15 W. west facing 8.5 percent slope in native range.	Sandstone	0-9	16	1.77	9	100	90	63	32	16	12	22	2
		9-17	NP	NP	NP	100	99	76	50	18	13	NP	NP
		17-25	NP	NP	NP	100	100	94	82	13	8	NP	NP
[1]Tivoli: about 2,540 feet north and 50 feet west of SW corner of sec. 16, T. 19 N., R. 19 W. north facing 8 percent slope.	Sandy material	0-7	NP	NP	NP	100	99	19	12	3	2	NP	NP
		7-60	NP	NP	NP	100	99	12	9	4	4	NP	NP
Woodward: about 1,900 feet south and 300 feet east of the NW corner of sec. 18, T. 9 N., R. 15 W. west facing 8 percent slope in native range.	Sandstone	0-14	12	1.89	21	100	100	81	47	20	15	26	4
		14-29	15	1.85	14	100	100	87	54	22	14	24	5
		35-45	14	1.85	13	100	99	96	80	23	14	24	5

[1]Correlated as an inclusion in Pratt loamy fine sand, 5 to 12 percent slopes.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
*Abilene	Fine, mixed, thermic Pachic Argiustolls
*Altus	Fine-loamy, mixed, thermic Pachic Argiustolls
*Amber	Coarse-silty, mixed, thermic Udic Ustochrepts
Binger	Fine-loamy, mixed, thermic Udic Rhodustalfs
Carey	Fine-silty, mixed, thermic Typic Argiustolls
Clairemont	Fine-silty, mixed (calcareous), thermic Typic Ustifluvents
Cordell	Loamy, mixed, thermic Lithic Ustochrepts
Cornick	Loamy, mixed, thermic, shallow Entic Haplustolls
Devol	Coarse-loamy, mixed, thermic Udic Haplustalfs
Dill	Coarse-loamy, mixed, thermic Udic Ustochrepts
Dodson	Fine, mixed, thermic Pachic Argiustolls
Dougherty	Loamy, mixed, thermic Arenic Haplustalfs
Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
Grandfield	Fine-loamy, mixed, thermic Udic Haplustalfs
Hardeman	Coarse-loamy, mixed, thermic Typic Ustochrepts
Obaro	Fine-silty, mixed, thermic Typic Ustochrepts
Pond Creek	Fine-silty, mixed, thermic Pachic Argiustolls
Port	Fine-silty, mixed, thermic Cumulic Haplustolls
Pratt	Sandy, mixed, thermic Psammentic Haplustalfs
Quinlan	Loamy, mixed, thermic, shallow Typic Ustochrepts
Reinach	Coarse-silty, mixed, thermic Pachic Haplustolls
Retrop	Fine-silty, mixed (calcareous), thermic Aquic Udifluvents
Shellabarger	Fine-loamy, mixed, thermic Udic Argiustolls
St. Paul	Fine-silty, mixed, thermic Pachic Argiustolls
Vernon	Fine, mixed, thermic Typic Ustochrepts
Woodward	Coarse-silty, mixed, thermic Typic Ustochrepts
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents

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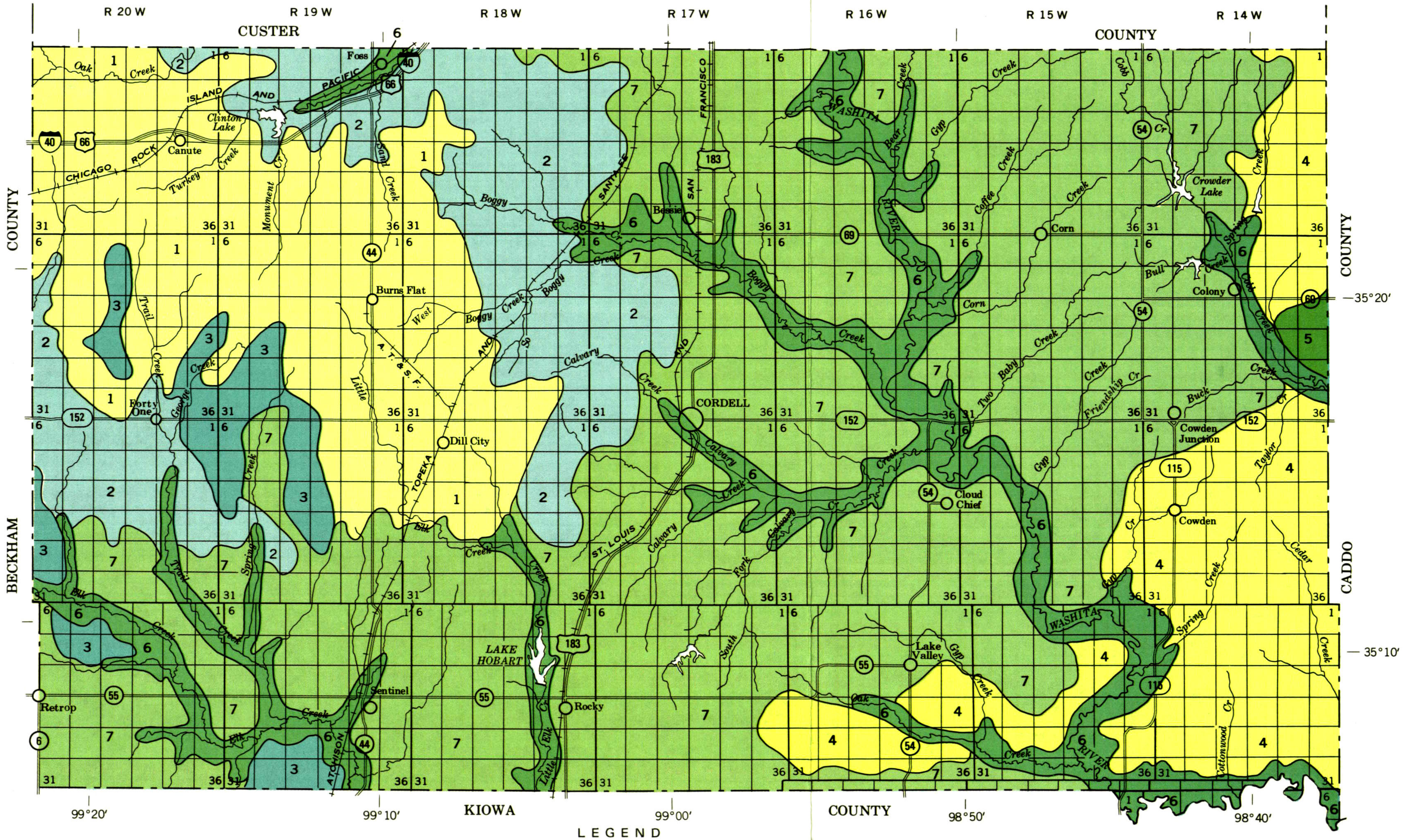


1	GRANDFIELD-DILL-QUINLAN: Deep to shallow, nearly level to rolling, well drained loamy soils that formed in loamy sediment or in material that weathered from weakly condolidated sandstone; on uplands
2	CORDELL-ROCK OUTCROP: Shallow, very gently sloping to moderately steep, somewhat excessively drained loamy soils that formed in material that weathered from hard red siltstone; on uplands
3	DEVOL-GRANDFIELD-PRATT: Deep, nearly level to strongly sloping, well drained sandy and loamy soils that formed in sandy or loamy eolian or alluvial material; on uplands
4	SHELLABARGER-HARDEMAN-POND CREEK: Deep, nearly level to sloping, well drained, loamy soils that formed in loamy material; on uplands
5	DOUGHERTY-EUFAULA: Deep, nearly level to sloping, well drained to somewhat excessively drained sandy soils that formed in thick sandy sediment or eolian material; on uplands
6	CLAIREMONT-PORT-REINACH: Deep, nearly level, well drained loamy soils that formed in alkaline loamy alluvium; on flood plains and low terraces
7	ST. PAUL-CAREY-OBARO: Deep and moderately deep, nearly level to strongly sloping, well drained loamy soils that formed in calcareous loamy material; on uplands

Compiled 1978

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

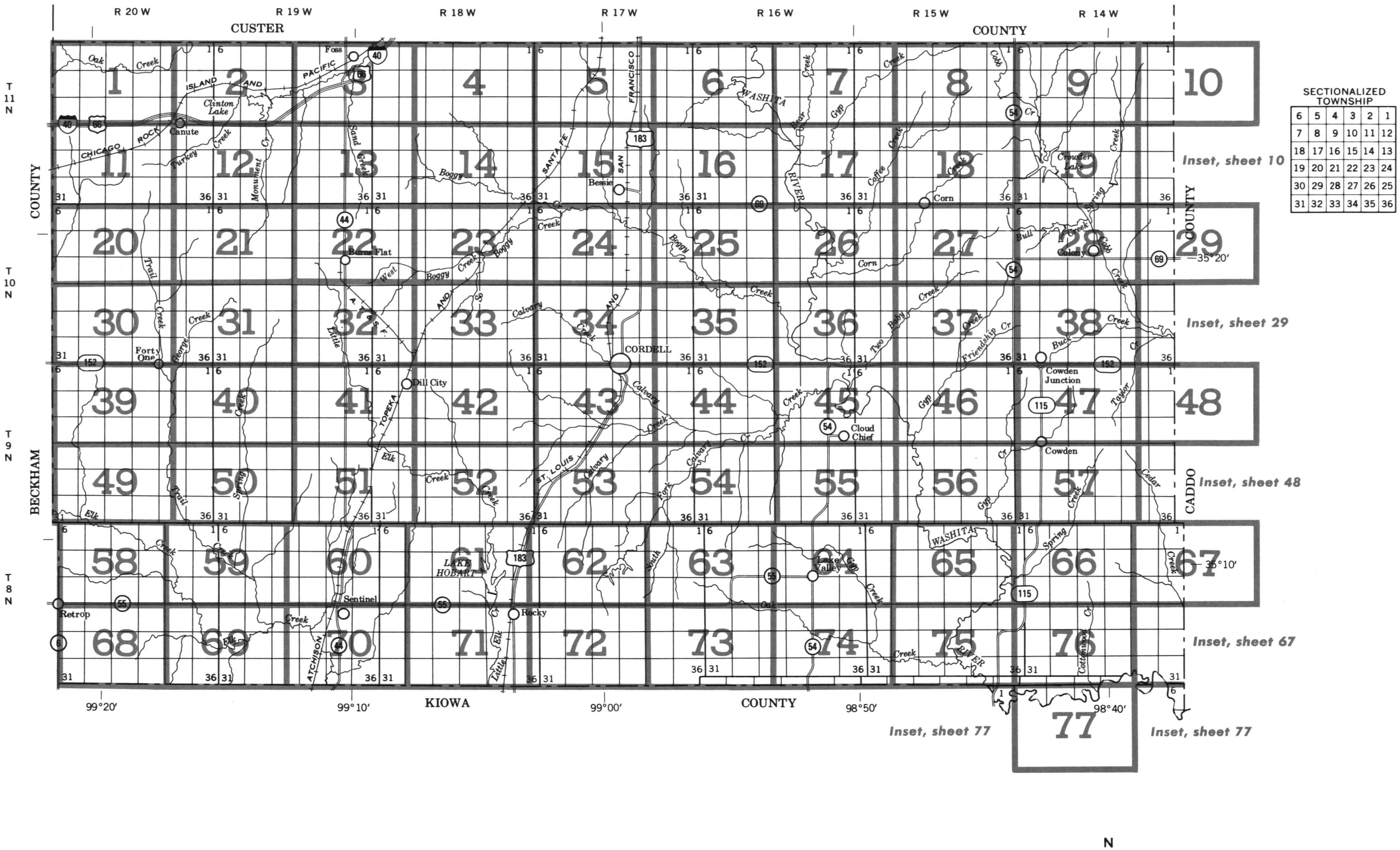
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

WASHITA COUNTY, OKLAHOMA

Scale 1:253,440

1 0 1 2 3 4 Miles



INDEX TO MAP SHEETS

WASHITA COUNTY, OKLAHOMA

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

Map symbols will be published as Arabic numerals. The symbol (W) following the approved name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be reliably estimated.

SYMBOL	NAME
1	Abilene silt loam, 0 to 1 percent slopes
2	Altus and Grandfield soils, 0 to 1 percent slopes
3	Altus and Grandfield soils, 1 to 3 percent slopes
4	Amber very fine sandy loam, 3 to 8 percent slopes
5	Binger fine sandy loam, 1 to 3 percent slopes
6	Binger fine sandy loam, 3 to 5 percent slopes
7	Carey silt loam, 1 to 3 percent slopes
8	Carey silt loam, 3 to 5 percent slopes
9	Clairemont silt loam, occasionally flooded
10	Clairemont silt loam, frequently flooded
11	Cordell silty clay loam, 1 to 5 percent slopes
12	Cordell-Rock outcrop complex, 2 to 15 percent slopes
13	Cornick-Rock outcrop complex, 1 to 12 percent slopes
14	Devol loamy fine sand, 0 to 3 percent slopes (W)
15	Devol loamy fine sand, 3 to 8 percent slopes (W)
16	Devol-Grandfield complex, 0 to 3 percent slopes (W)
17	Devol-Grandfield complex, 3 to 8 percent slopes (W)
18	Dill fine sandy loam, 1 to 3 percent slopes
19	Dill-Quinlan complex, 1 to 3 percent slopes
20	Dill-Quinlan complex, 3 to 5 percent slopes
21	Dill-Quinlan complex, 5 to 12 percent slopes
22	Dodson silt loam, 0 to 1 percent slopes
23	Dougherty-Eufaula complex, 3 to 8 percent slopes (W)
24	Grandfield fine sandy loam, 0 to 1 percent slopes
25	Grandfield fine sandy loam, 1 to 3 percent slopes
26	Grandfield fine sandy loam, 3 to 5 percent slopes
27	Hardeman fine sandy loam, 1 to 3 percent slopes
28	Hardeman fine sandy loam, 3 to 5 percent slopes
29	Hardeman fine sandy loam, 5 to 8 percent slopes
30	Obaro silty clay loam, 1 to 3 percent slopes
31	Obaro silty clay loam, 3 to 5 percent slopes
32	Obaro silty clay loam, 2 to 5 percent slopes, eroded
33	Pond Creek fine sandy loam, 0 to 1 percent slopes
34	Pond Creek fine sandy loam, 1 to 3 percent slopes
35	Port silt loam
36	Pratt loamy fine sand, 5 to 12 percent slopes (W)
37	Quinlan-Obaro complex, 5 to 12 percent slopes
38	Quinlan-Rock outcrop complex, 8 to 20 percent slopes
39	Quinlan-Woodward complex, 2 to 5 percent slopes, eroded
40	Quinlan-Woodward complex, 5 to 12 percent slopes
41	Quinlan and Dill soils, 2 to 12 percent slopes, severely eroded
42	Reinach silt loam
43	Retrop silty clay loam
44	Shellabarger fine sandy loam, 1 to 3 percent slopes
45	Shellabarger fine sandy loam, 3 to 5 percent slopes
46	St. Paul silt loam, 0 to 1 percent slopes
47	St. Paul silt loam, 1 to 3 percent slopes
48	St. Paul silt loam, 3 to 5 percent slopes
49	Vernon-Rock outcrop complex, 2 to 12 percent slopes
50	Woodward silt loam, 1 to 3 percent slopes
51	Woodward silt loam, 3 to 5 percent slopes
52	Woodward silt loam, 5 to 8 percent slopes
53	Woodward-Clairemont complex
54	Woodward-Quinlan complex, 1 to 3 percent slopes
55	Woodward-Quinlan complex, 3 to 5 percent slopes
56	Yahola fine sandy loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

CeA FoB2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

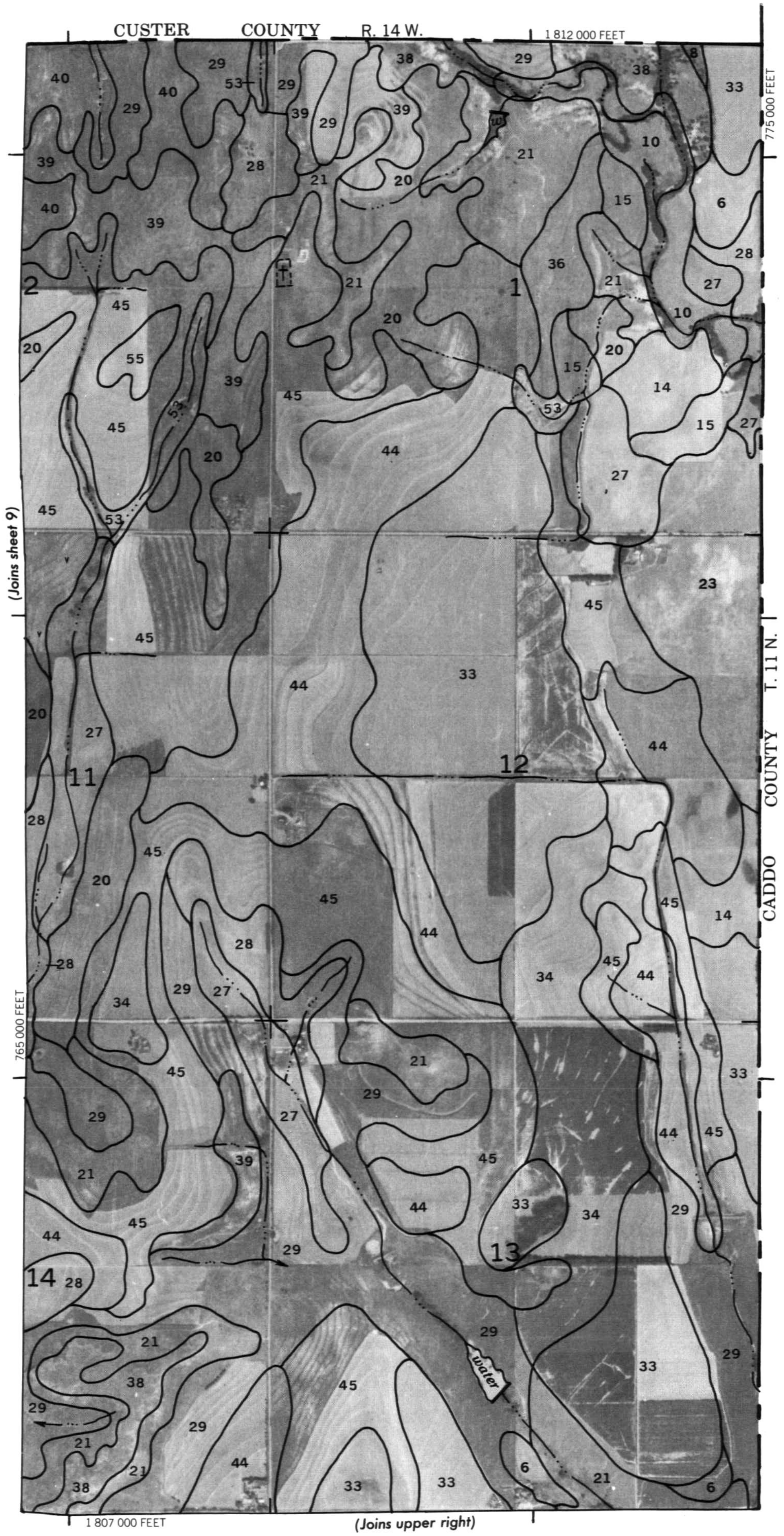
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

WASHITA COUNTY, OKLAHOMA NO. 1

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(10)



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WASHITA COUNTY, OKLAHOMA NO. 10

WASHITA COUNTY, OKLAHOMA NO. 11

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WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 12

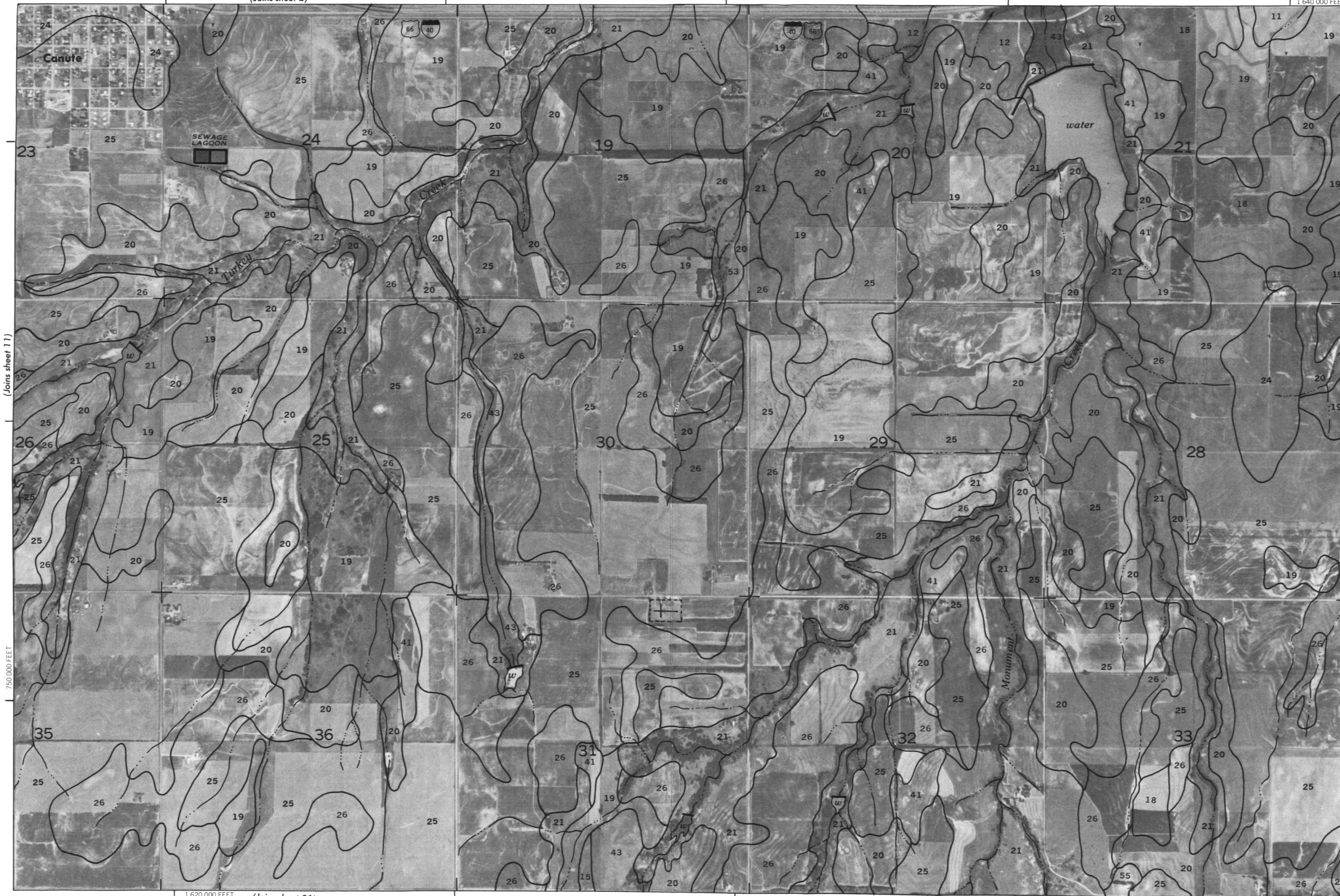
N

1 Mile
5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



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WASHITA COUNTY, OKLAHOMA NO. 12

13

WASHITA COUNTY, OKLAHOMA NO. 13

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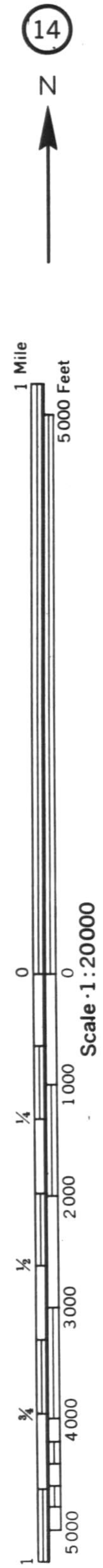
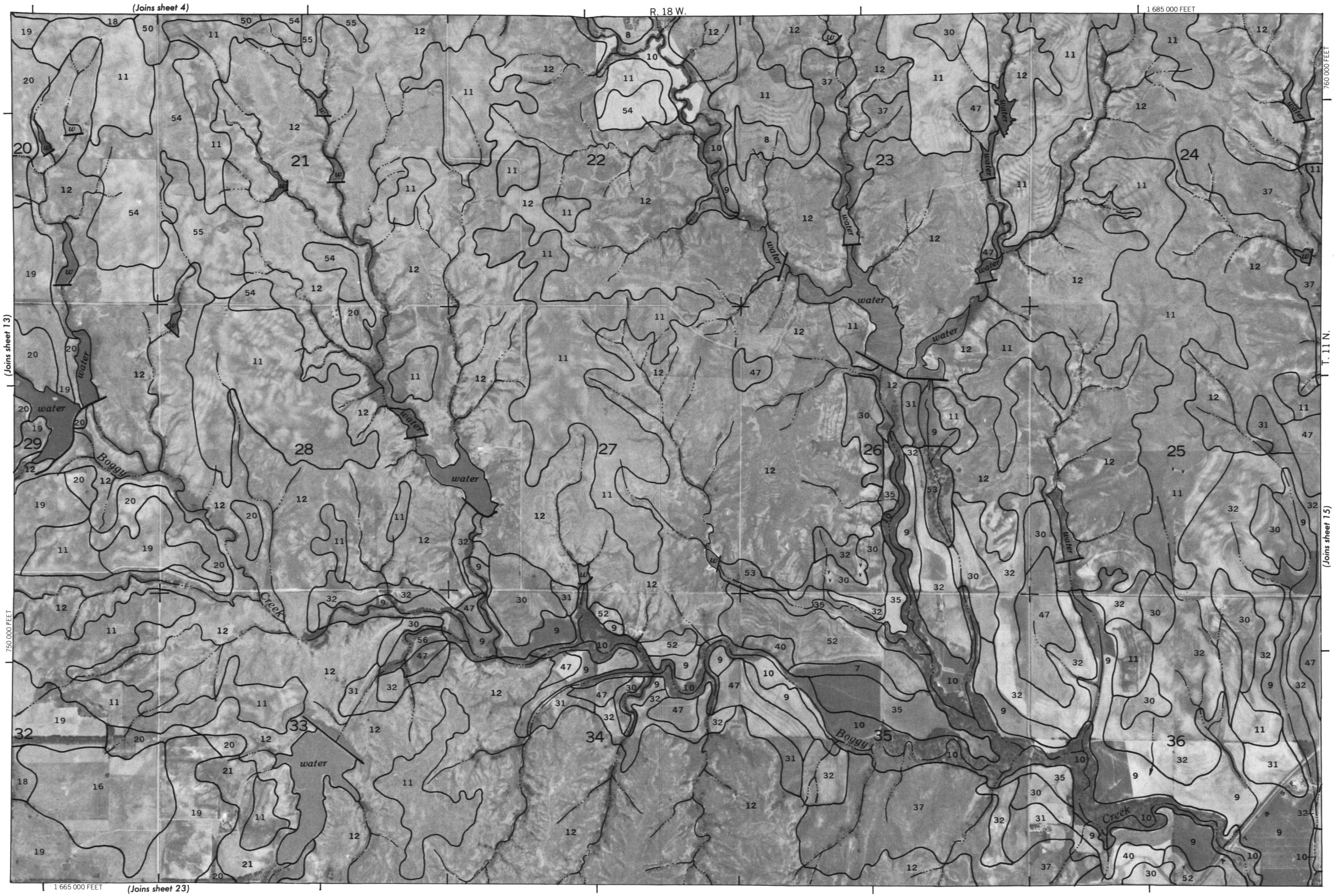
WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 14





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WASHITA COUNTY, OKLAHOMA NO. 14

15

WASHITA COUNTY, OKLAHOMA NO. 15

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WASHITA COUNTY, OKLAHOMA NO. 16

17

N

1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20000

WASHITA COUNTY, OKLAHOMA NO. 17

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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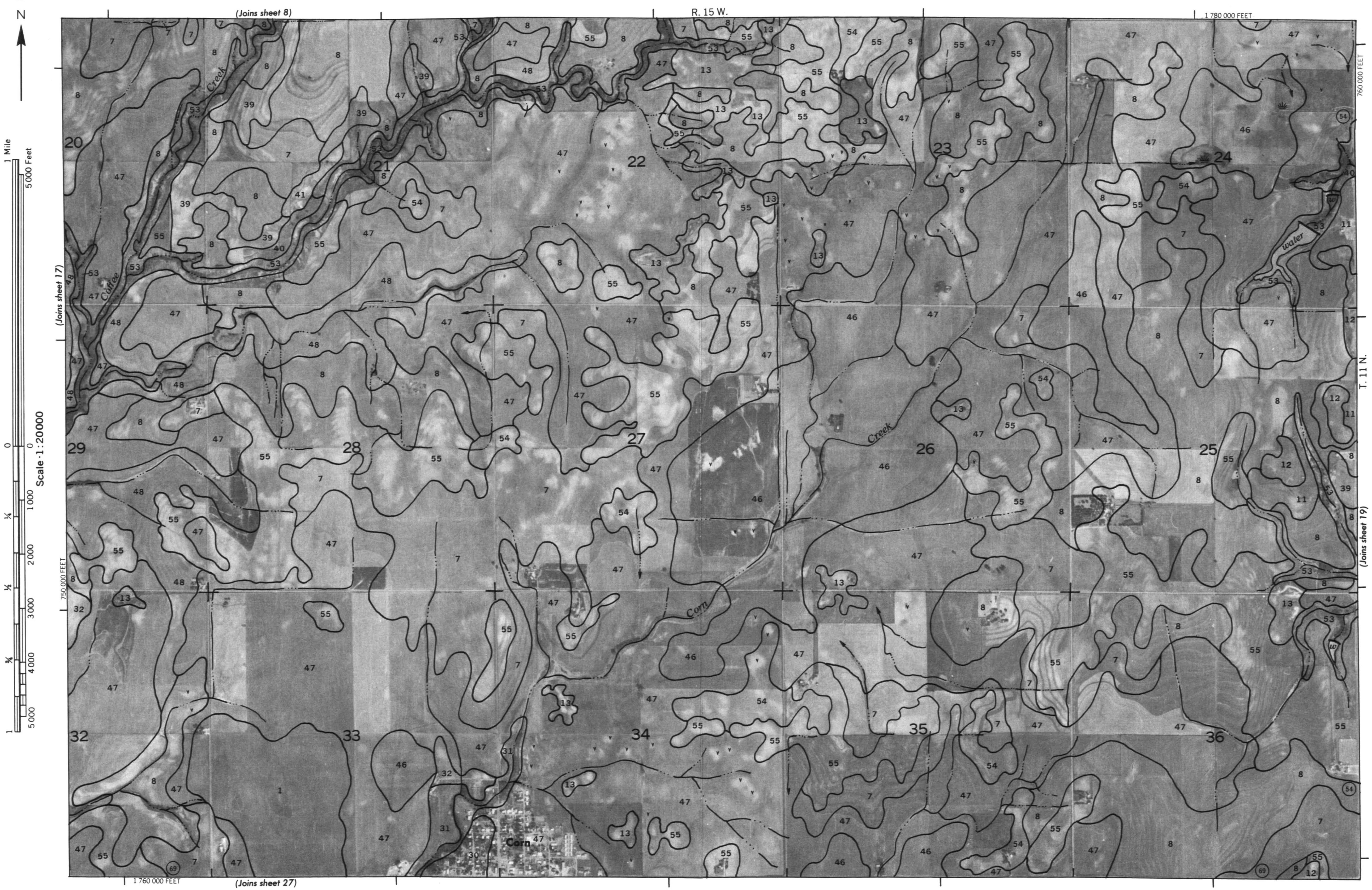
WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 18



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WASHITA COUNTY, OKLAHOMA NO. 18

WASHITA COUNTY, OKLAHOMA NO. 19

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WASHITA COUNTY, OKLAHOMA NO. 2

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WASHITA COUNTY, OKLAHOMA NO. 21

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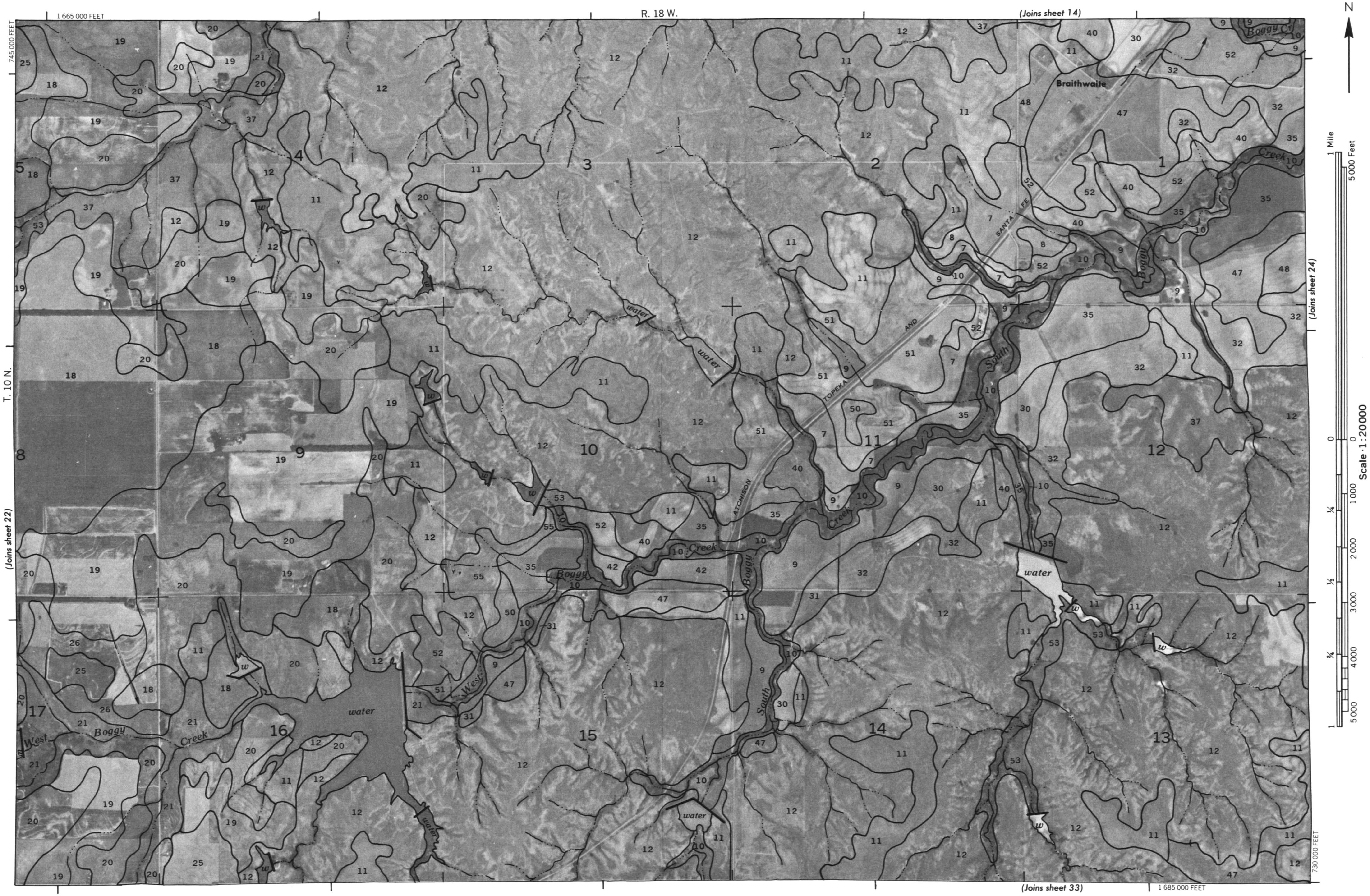
WASHITA COUNTY, OKLAHOMA NO. 22



WASHITA COUNTY, OKLAHOMA NO. 23

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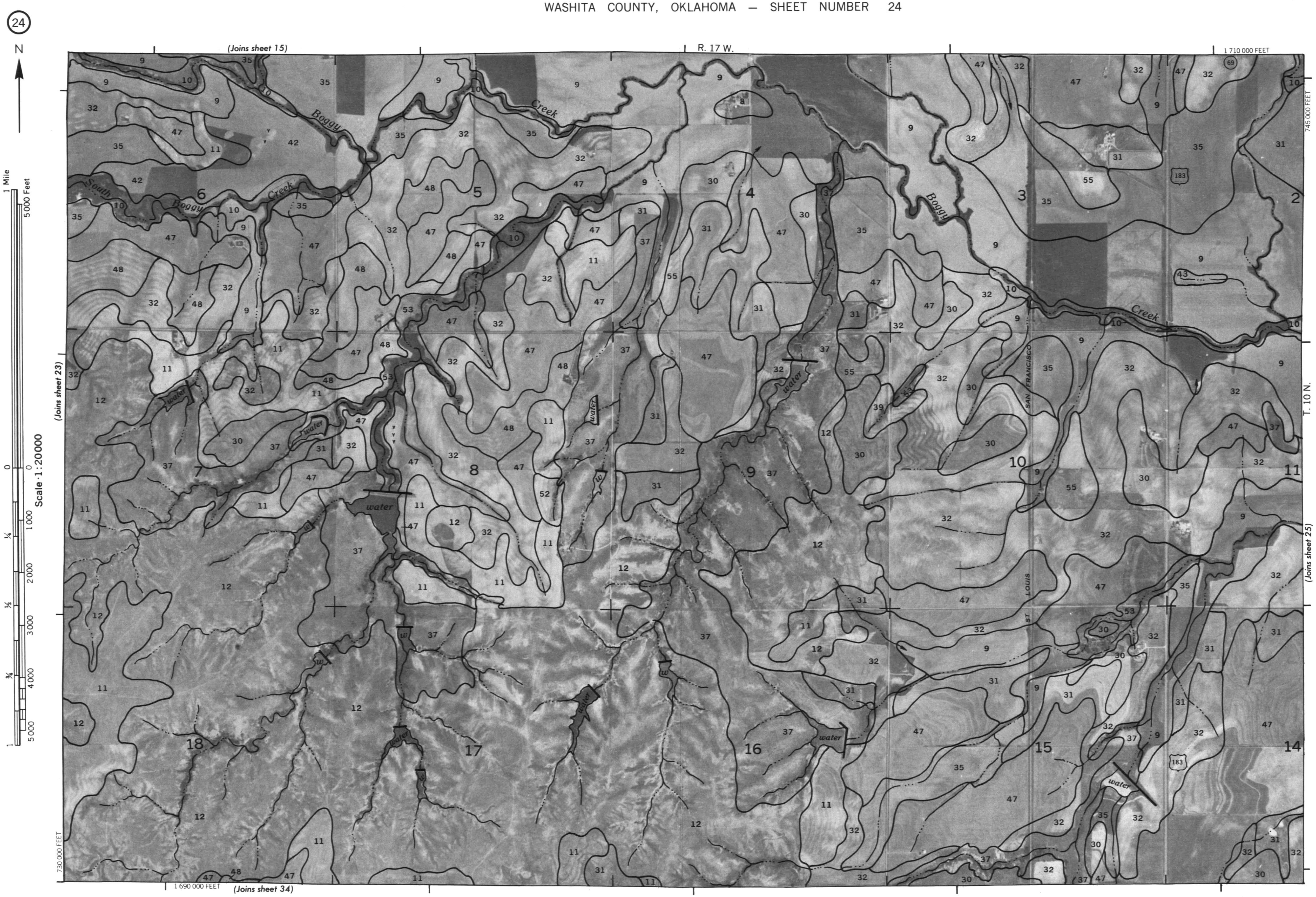

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WASHITA COUNTY, OKLAHOMA NO. 24

WASHITA COUNTY, OKLAHOMA NO. 25

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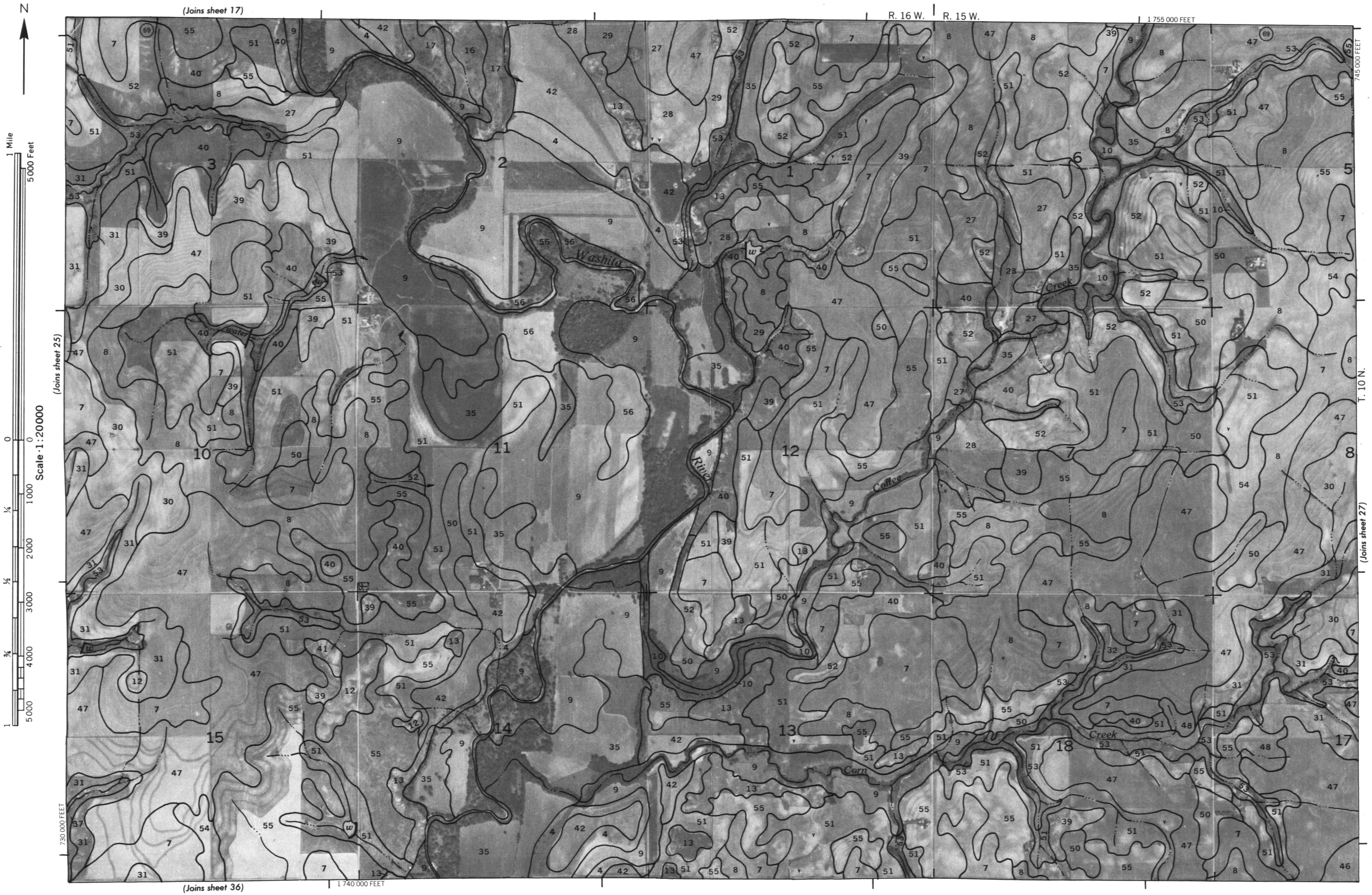
WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 26



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WASHITA COUNTY, OKLAHOMA NO. 26

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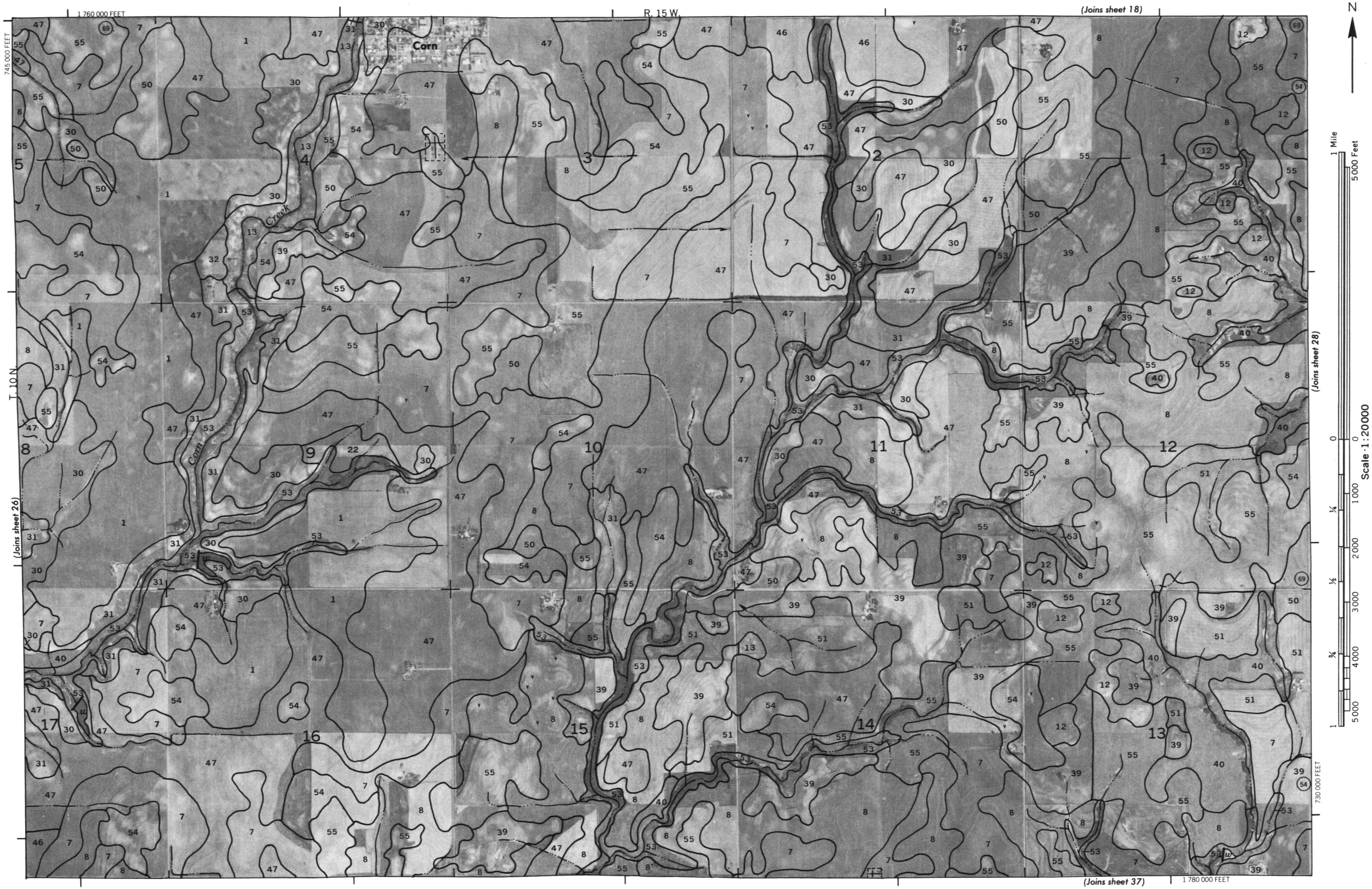

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WASHITA COUNTY, OKLAHOMA NO. 28

WASHITA COUNTY, OKLAHOMA NO. 29

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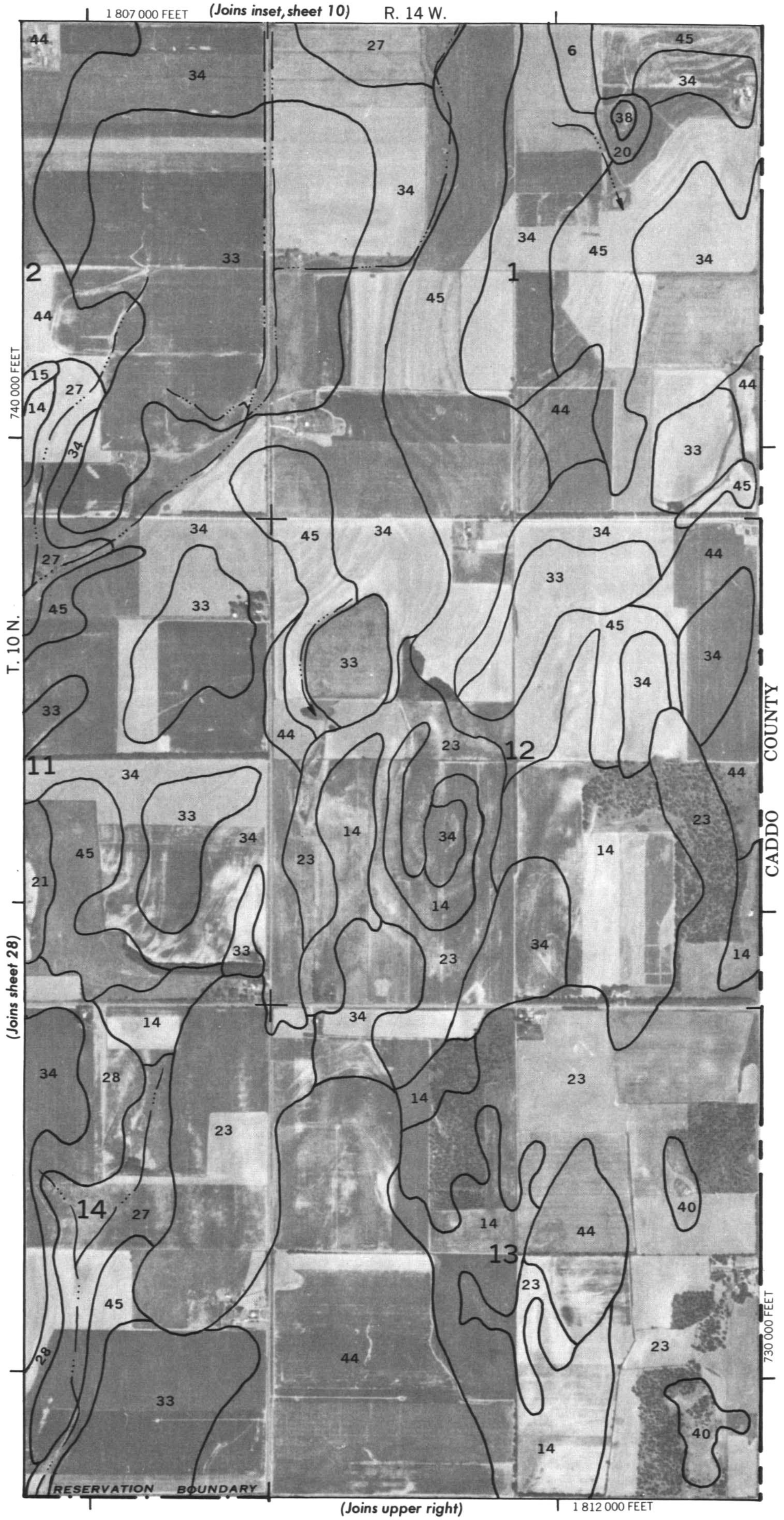

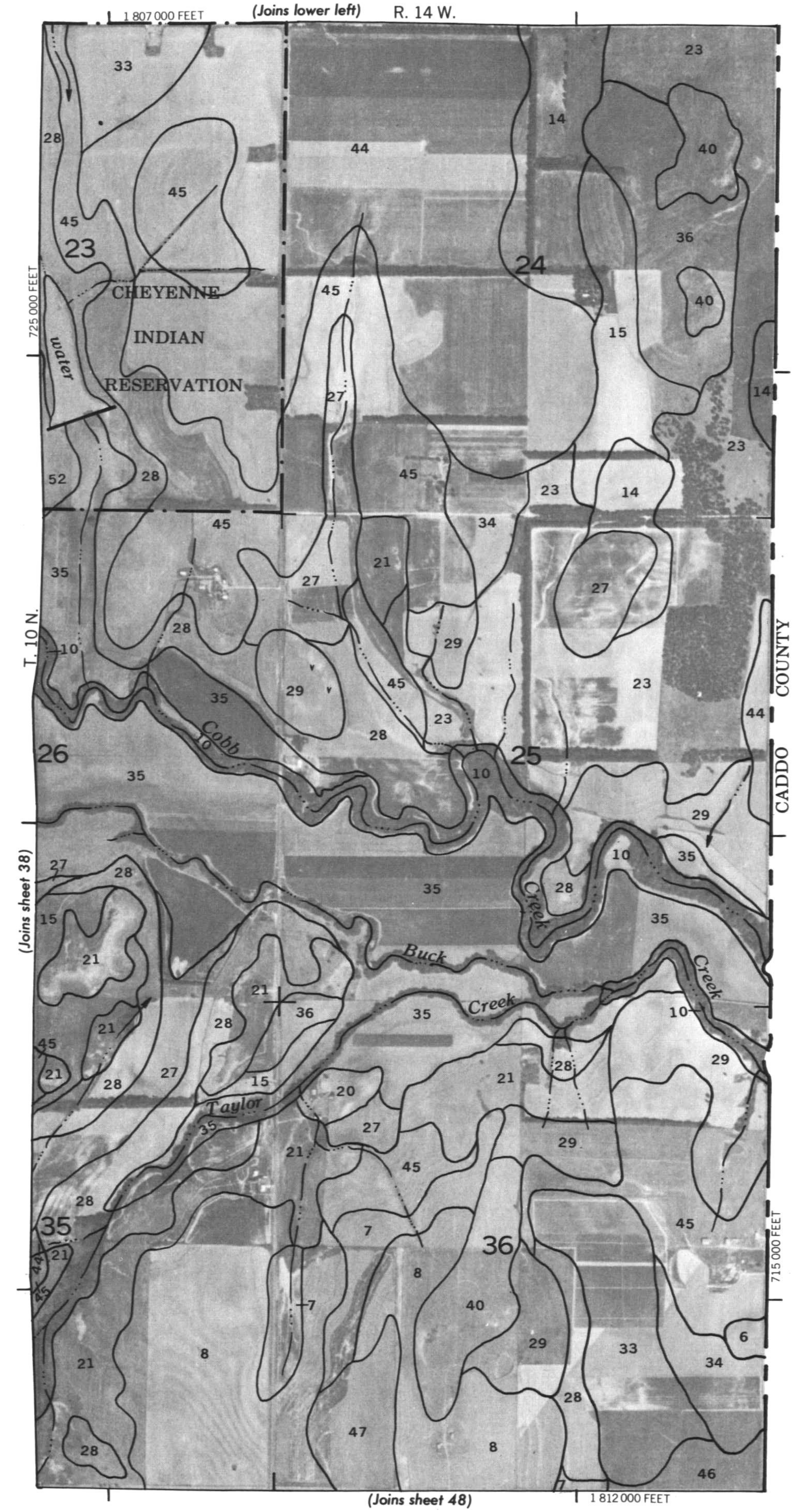

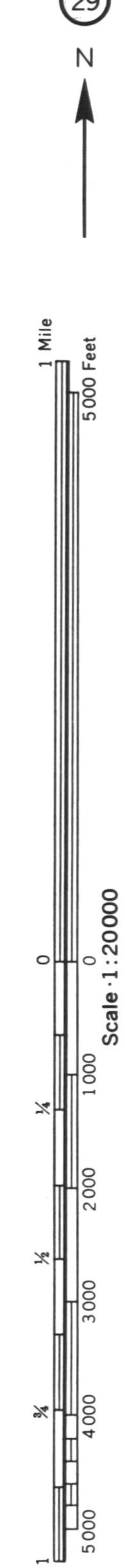

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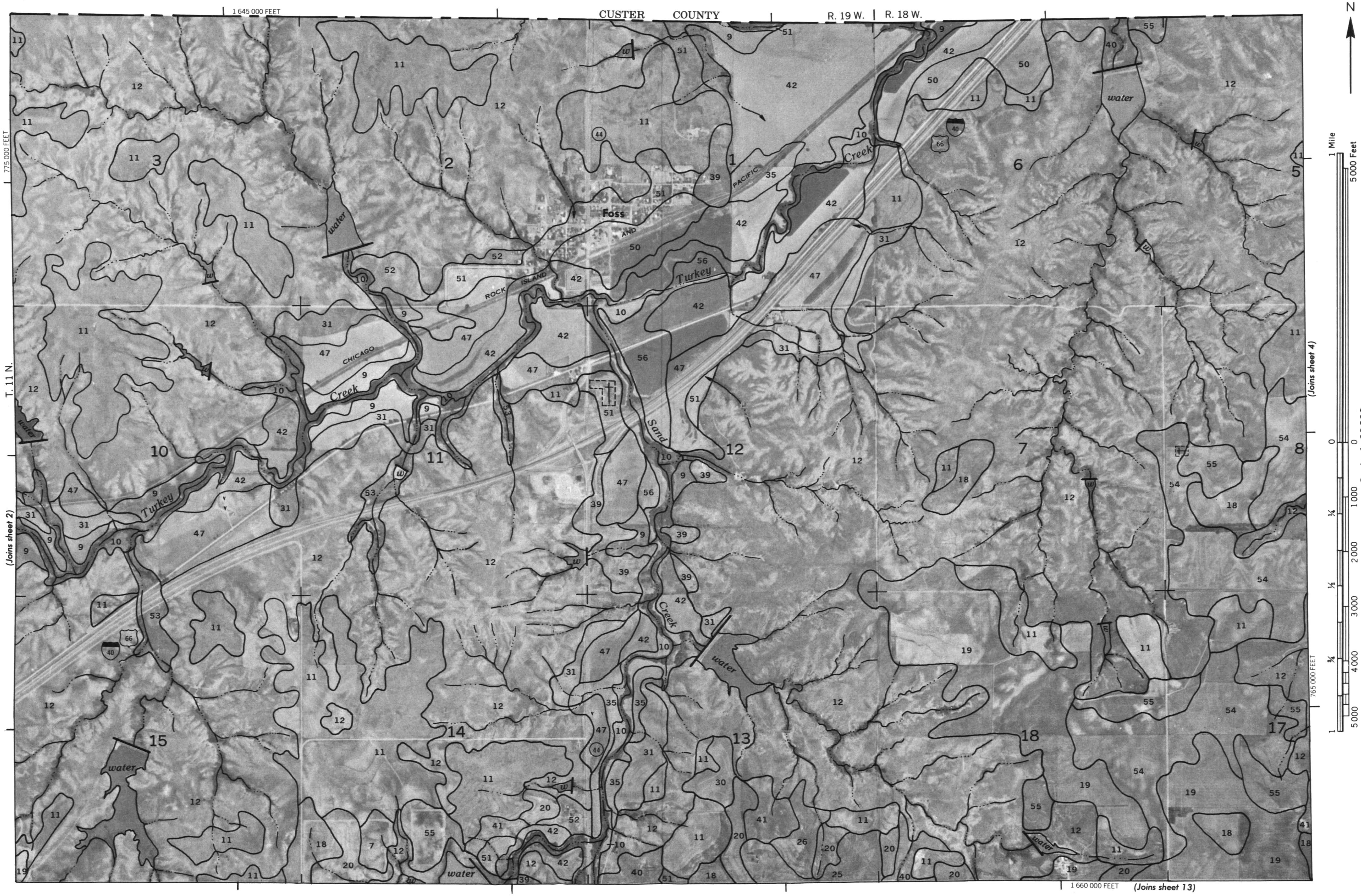

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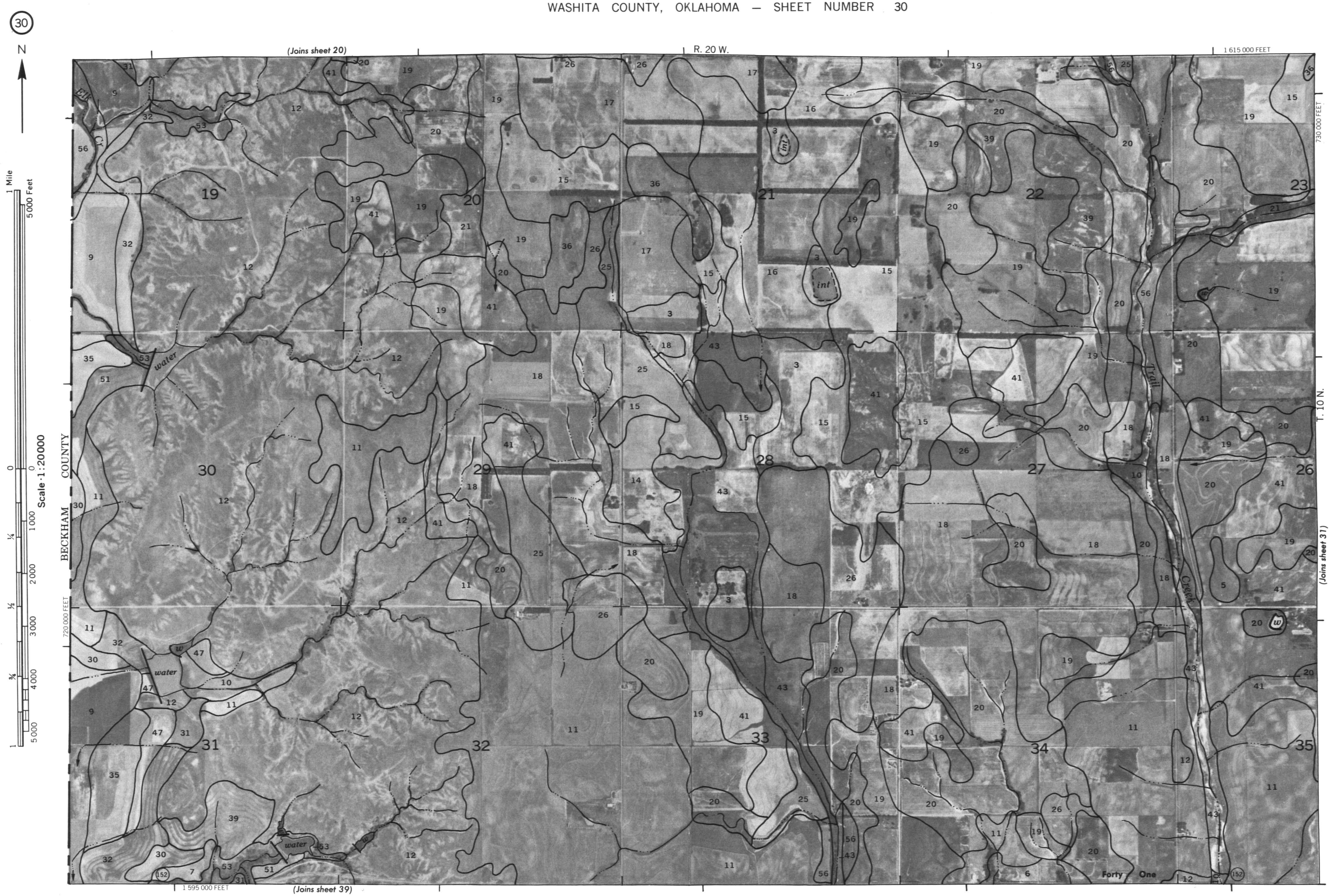

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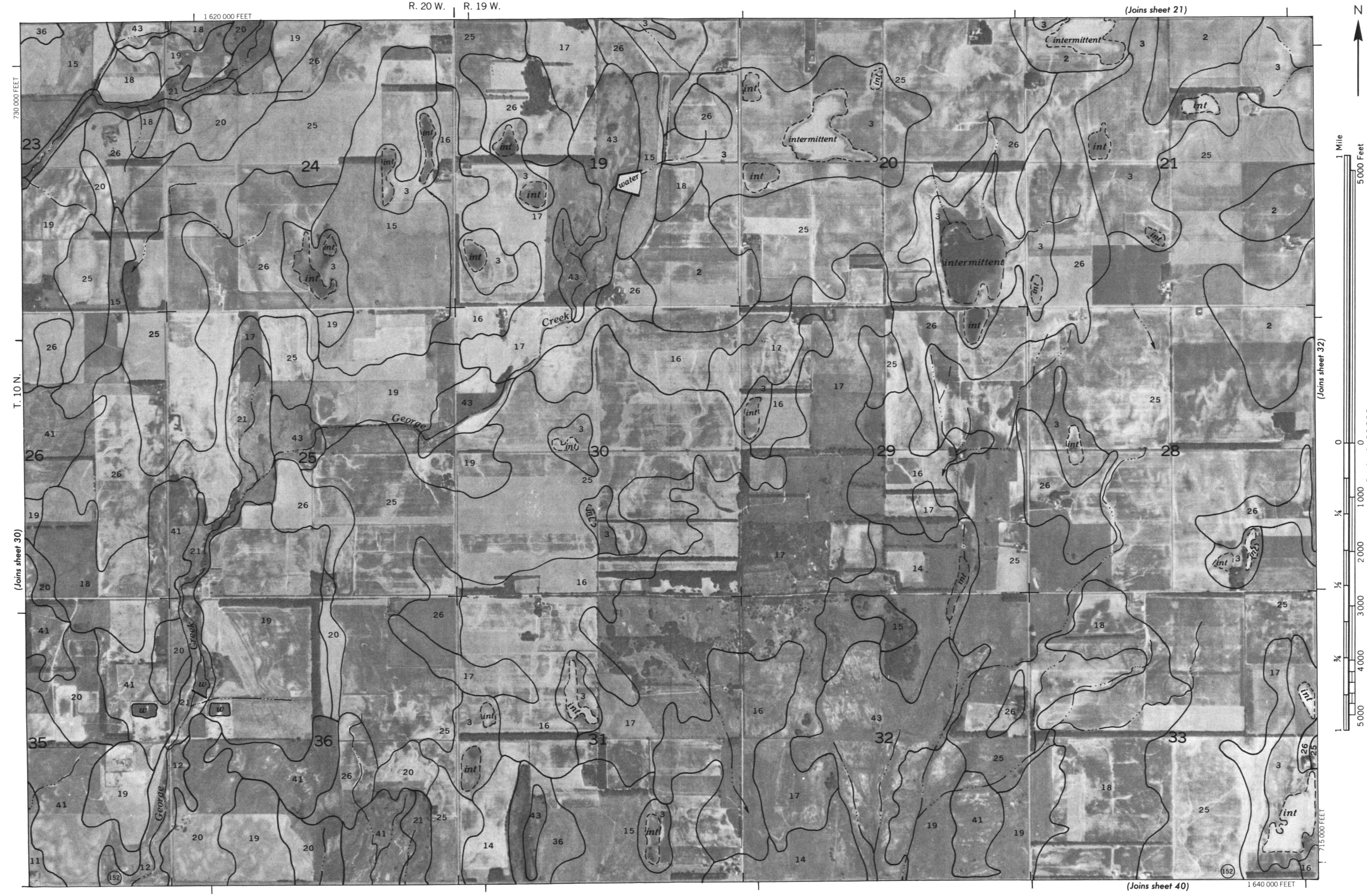
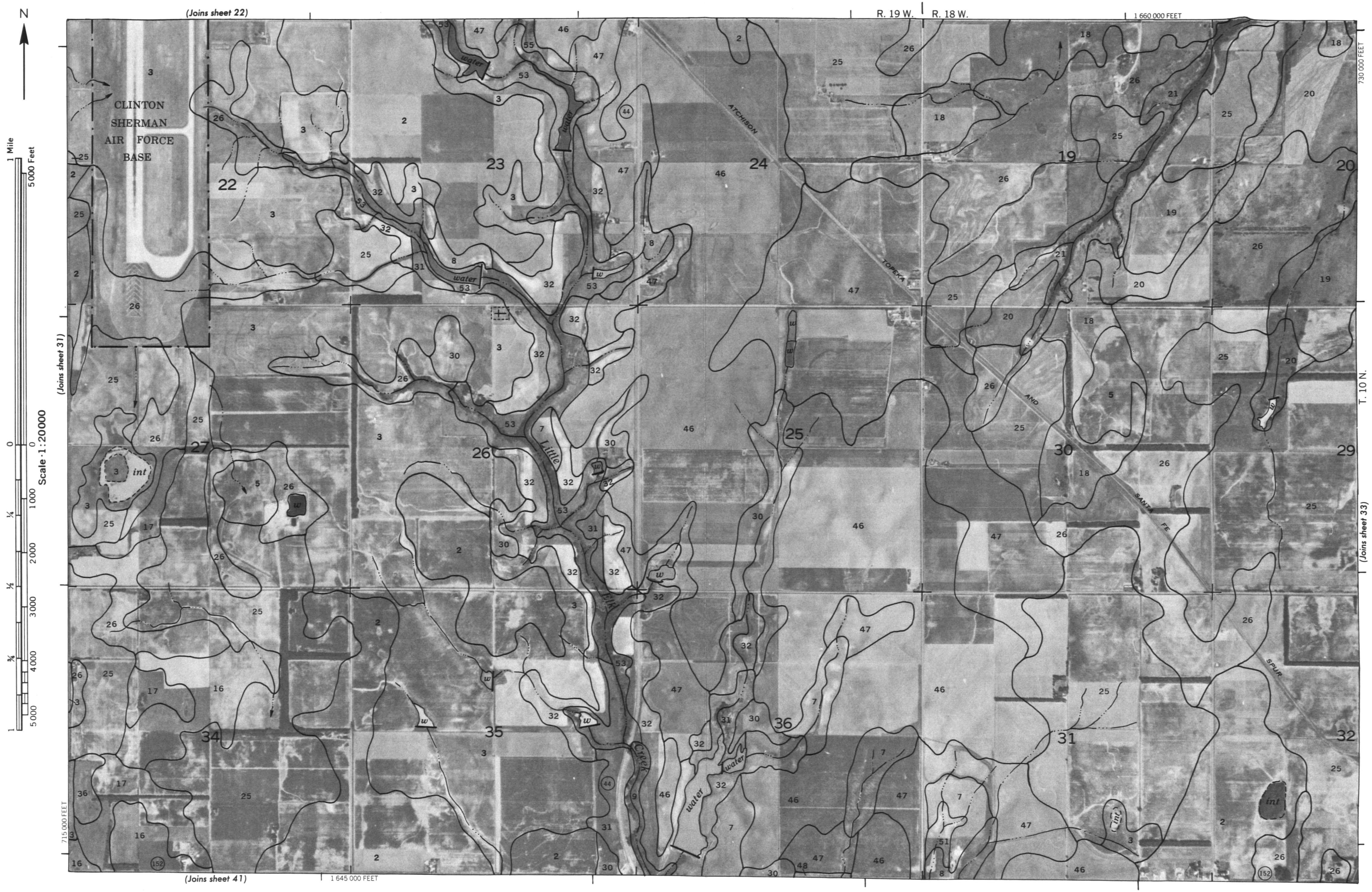


WASHITA COUNTY, OKLAHOMA NO. 31

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

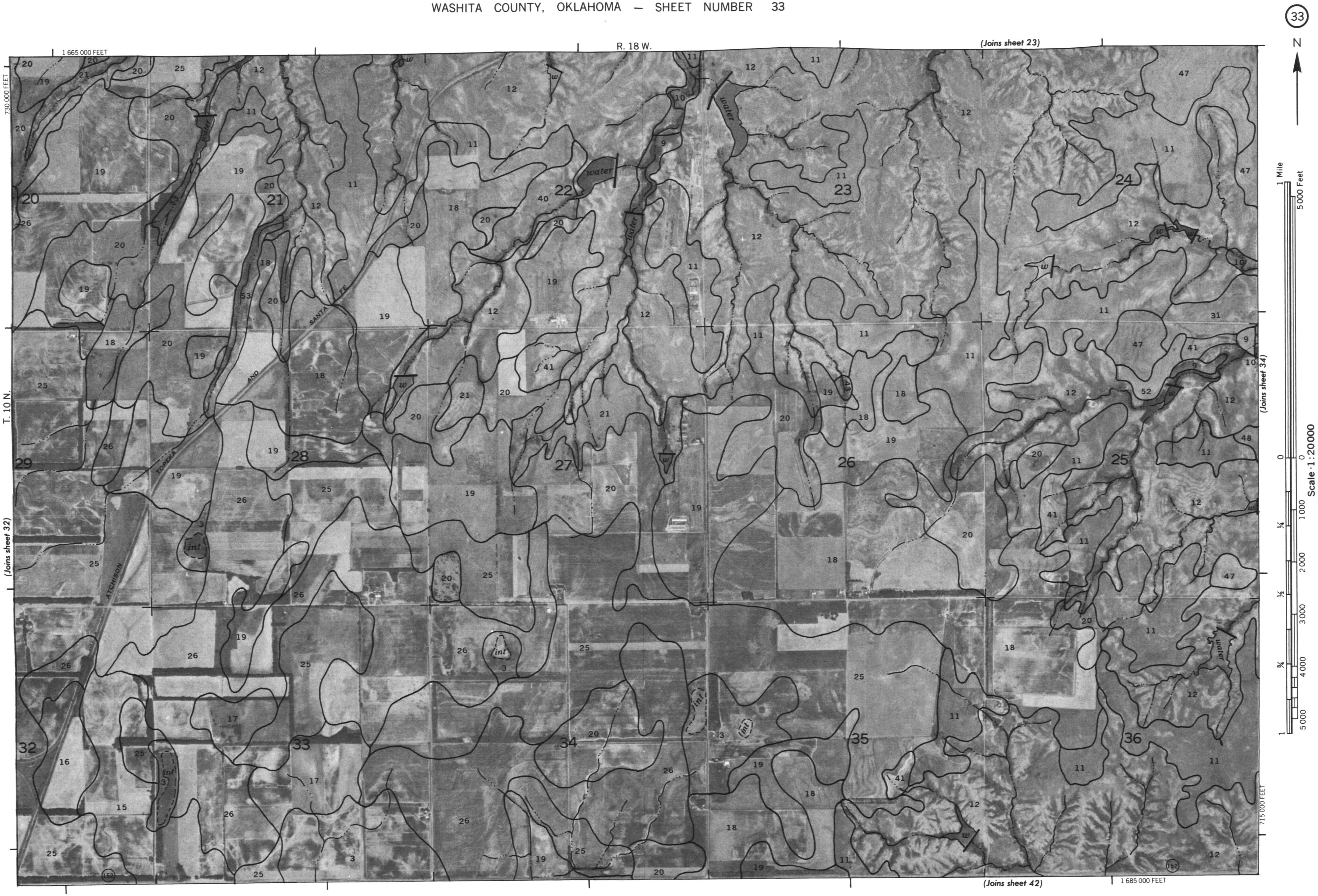
WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 32



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 32

WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 33



WASHITA COUNTY, OKLAHOMA NO. 33

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N

1 Mile

5000 Feet

Scale 1:20 000

(Joins sheet 24)

R. 17 W.

1 710 000 FEET

(Joins sheet 33)

(Joins sheet 35)

1 690 000 FEET

(Joins sheet 43)

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 34

35

WASHITA COUNTY, OKLAHOMA NO. 35

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WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 36

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WASHITA COUNTY, OKLAHOMA NO. 36

37

WASHITA COUNTY, OKLAHOMA NO. 37

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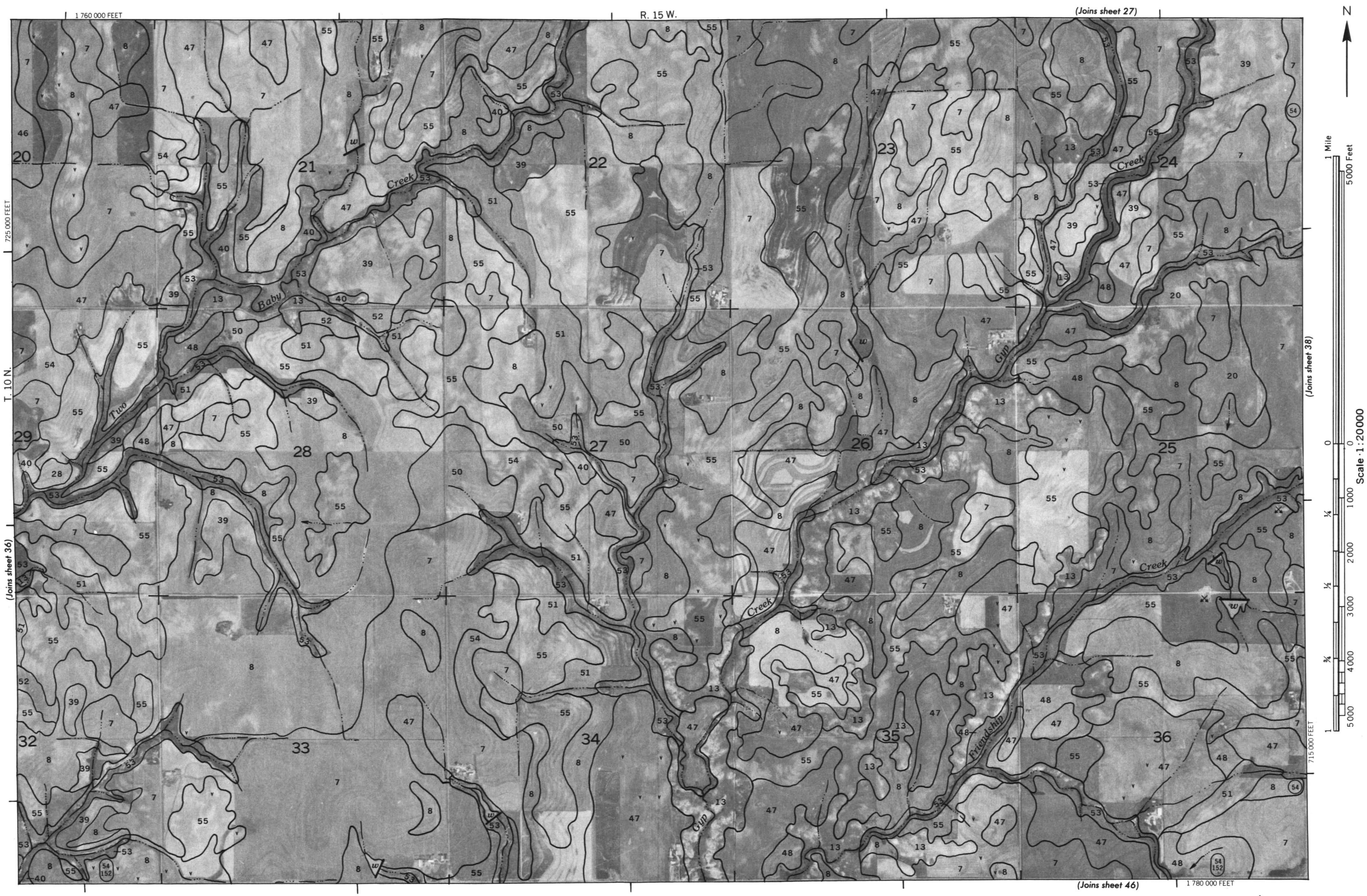

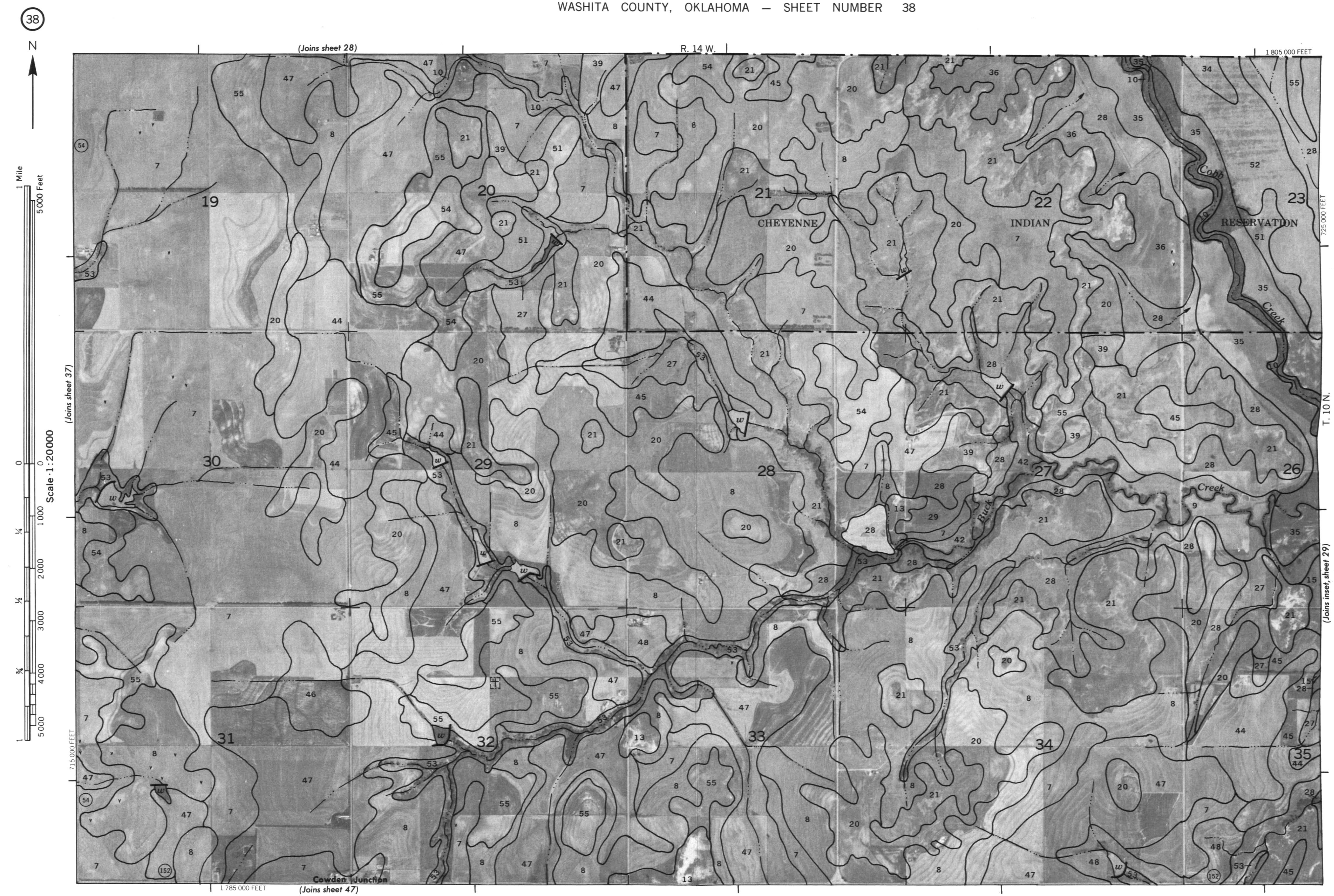

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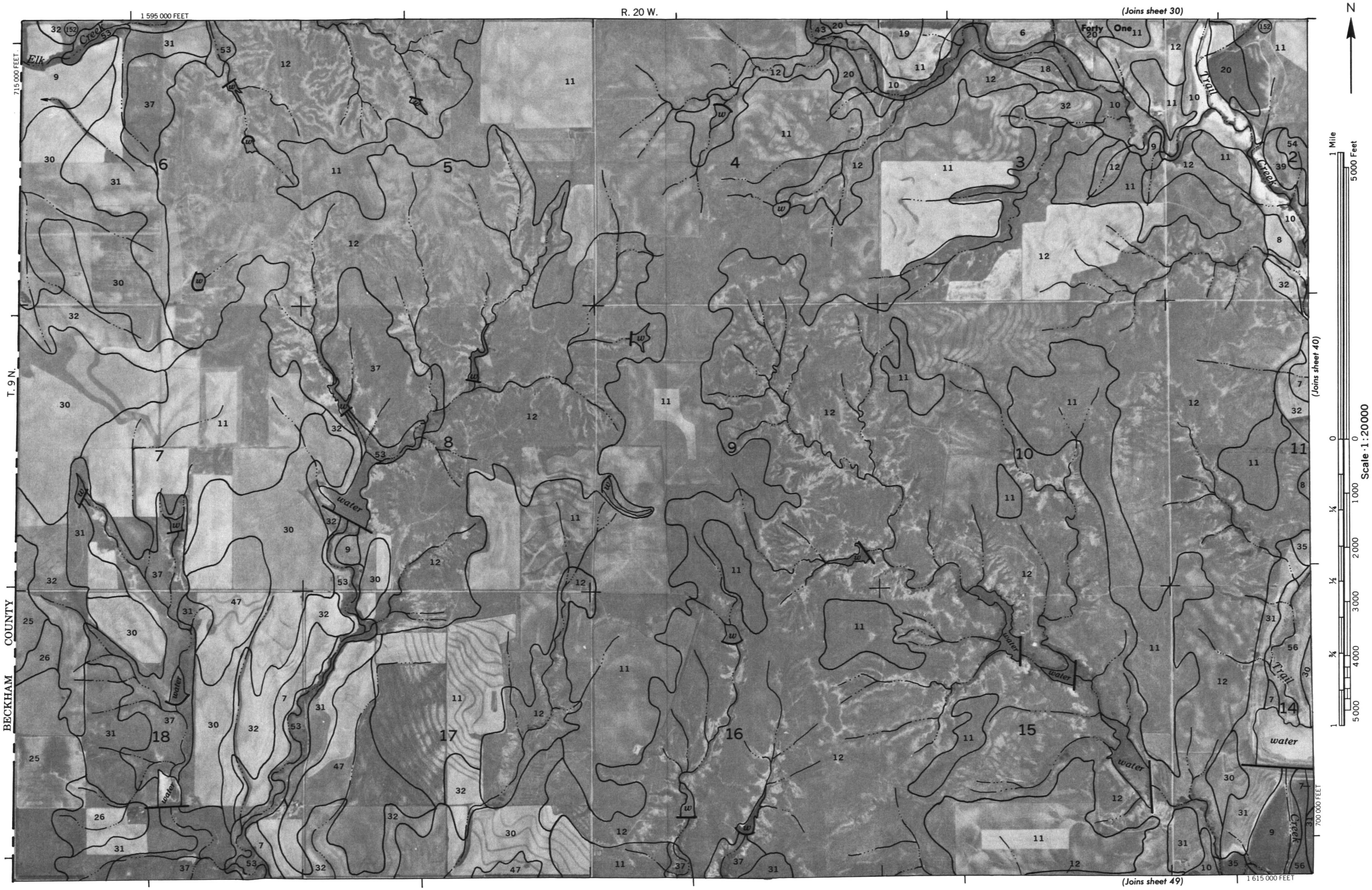
WASHITA COUNTY, OKLAHOMA NO. 38



WASHITA COUNTY, OKLAHOMA NO. 39

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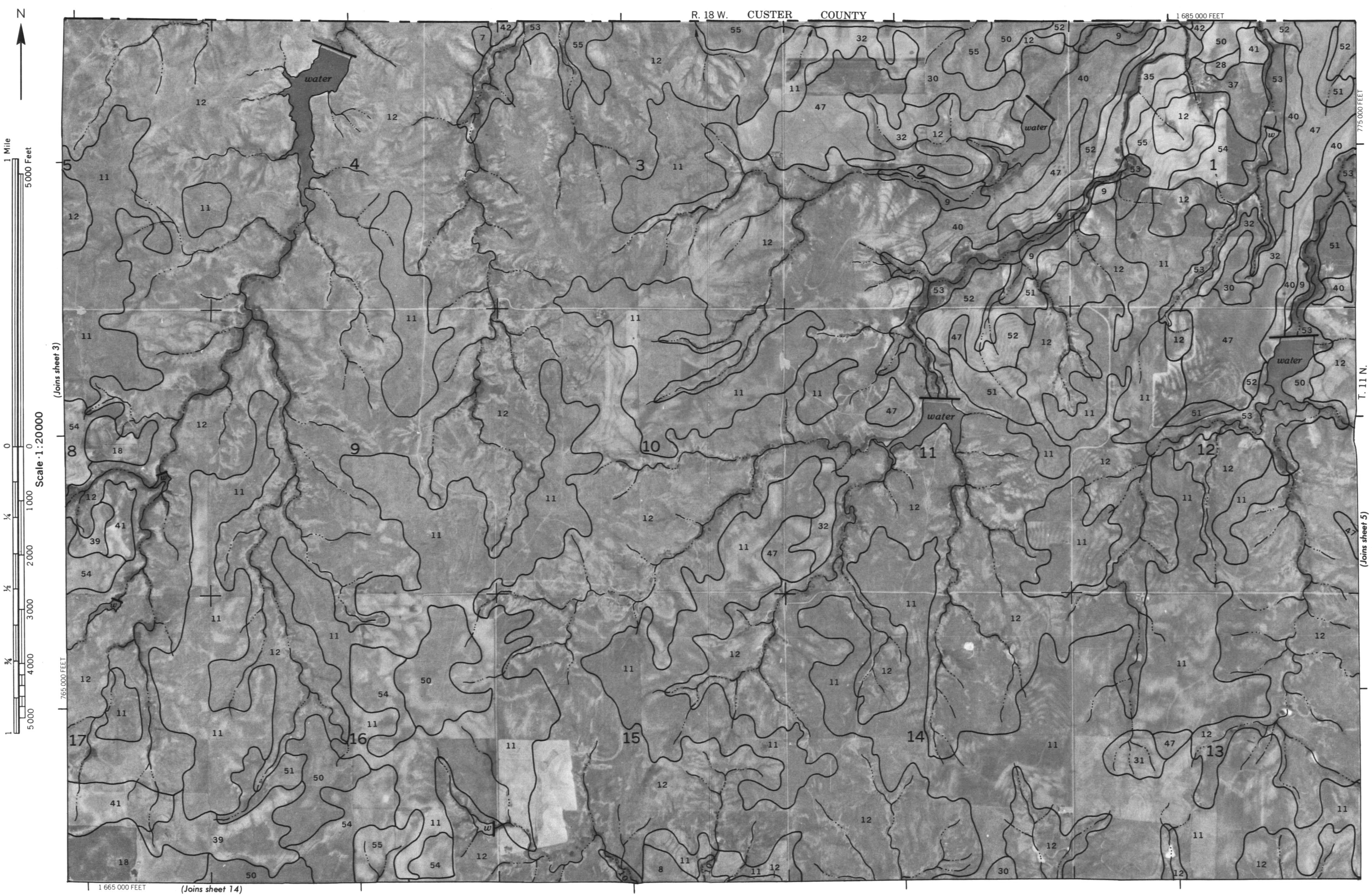
WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 4



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WASHITA COUNTY, OKLAHOMA NO. 4

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WASHITA COUNTY, OKLAHOMA NO. 40

41

WASHITA COUNTY, OKLAHOMA NO. 41

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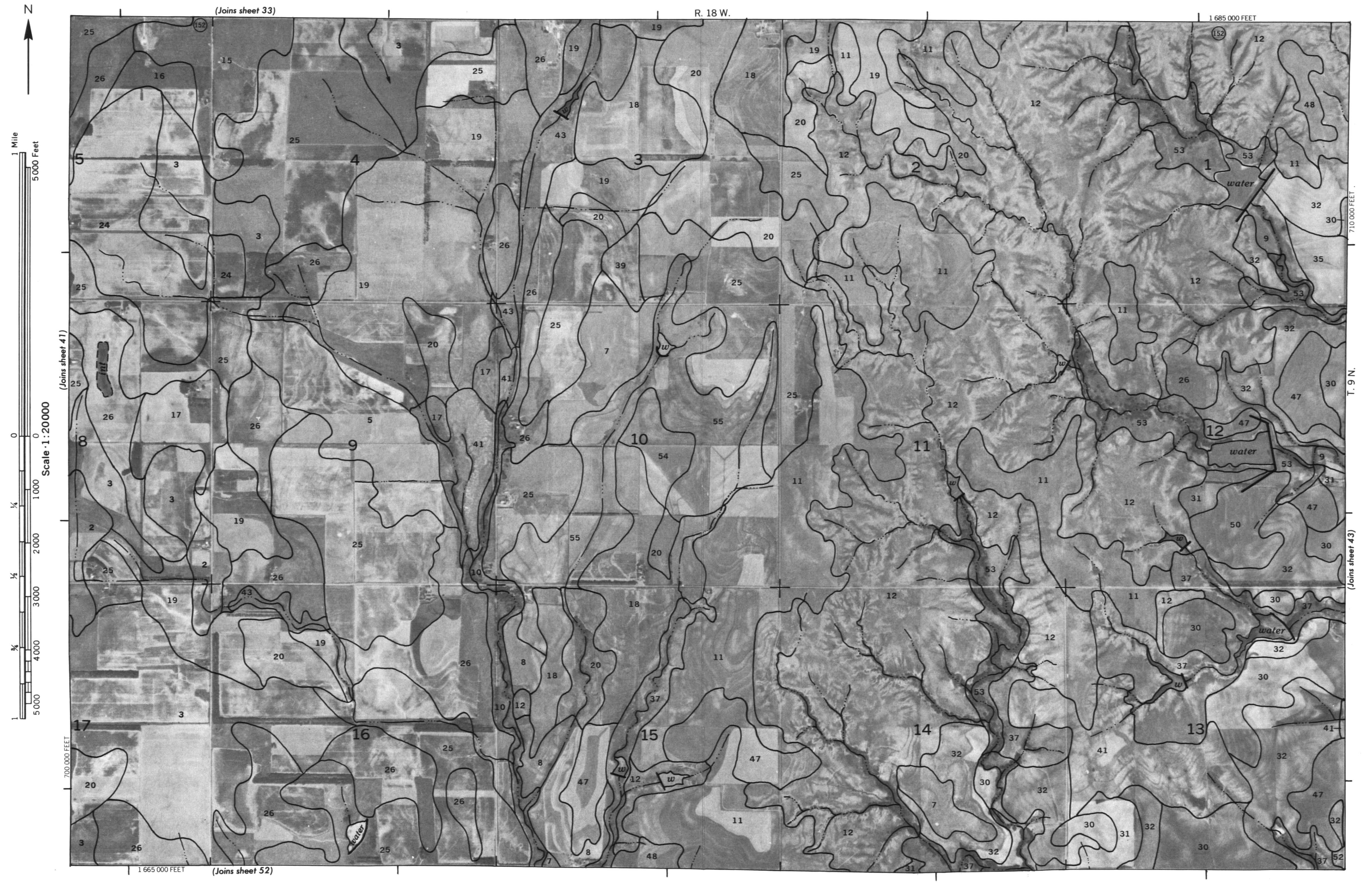
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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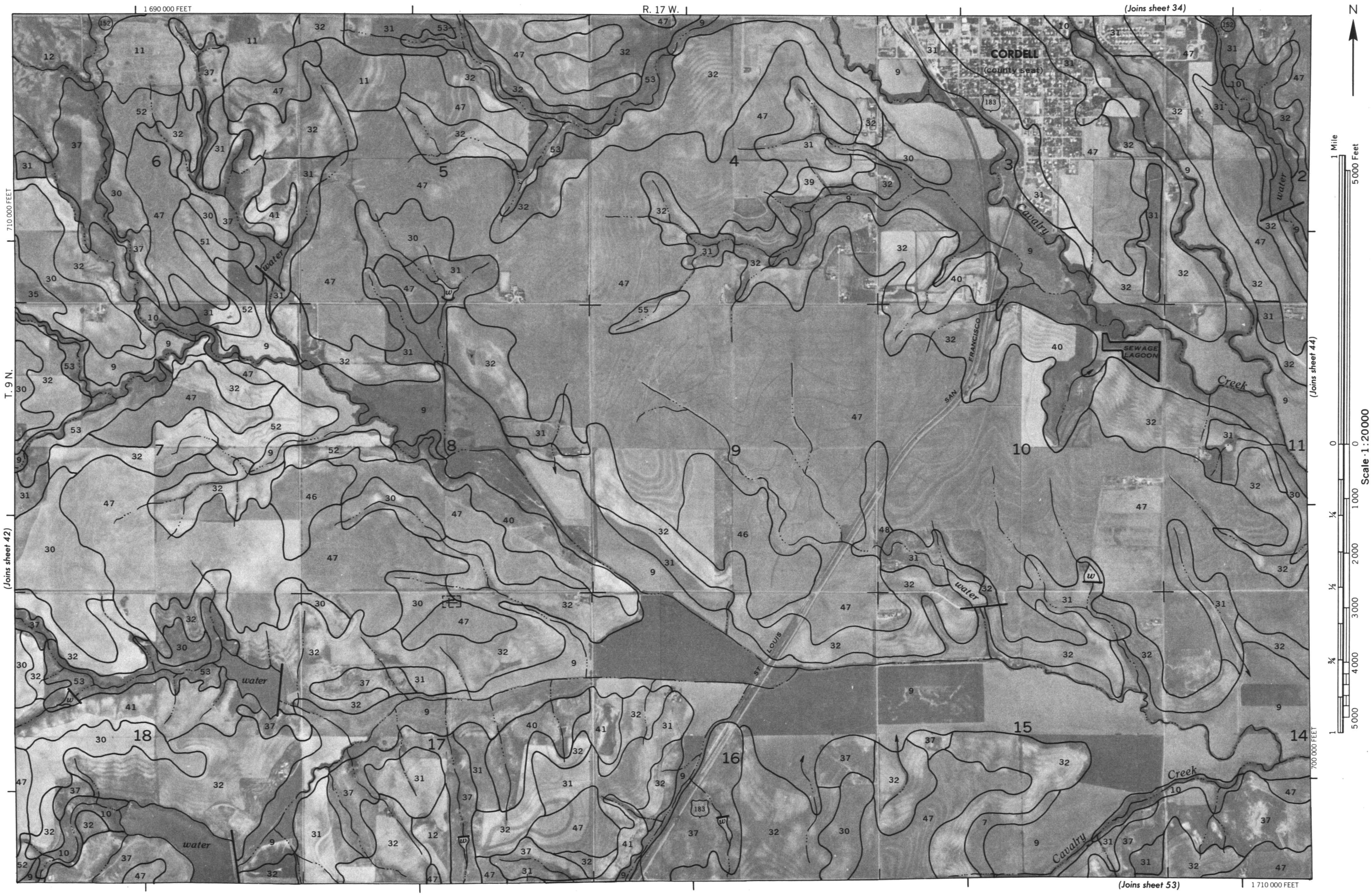


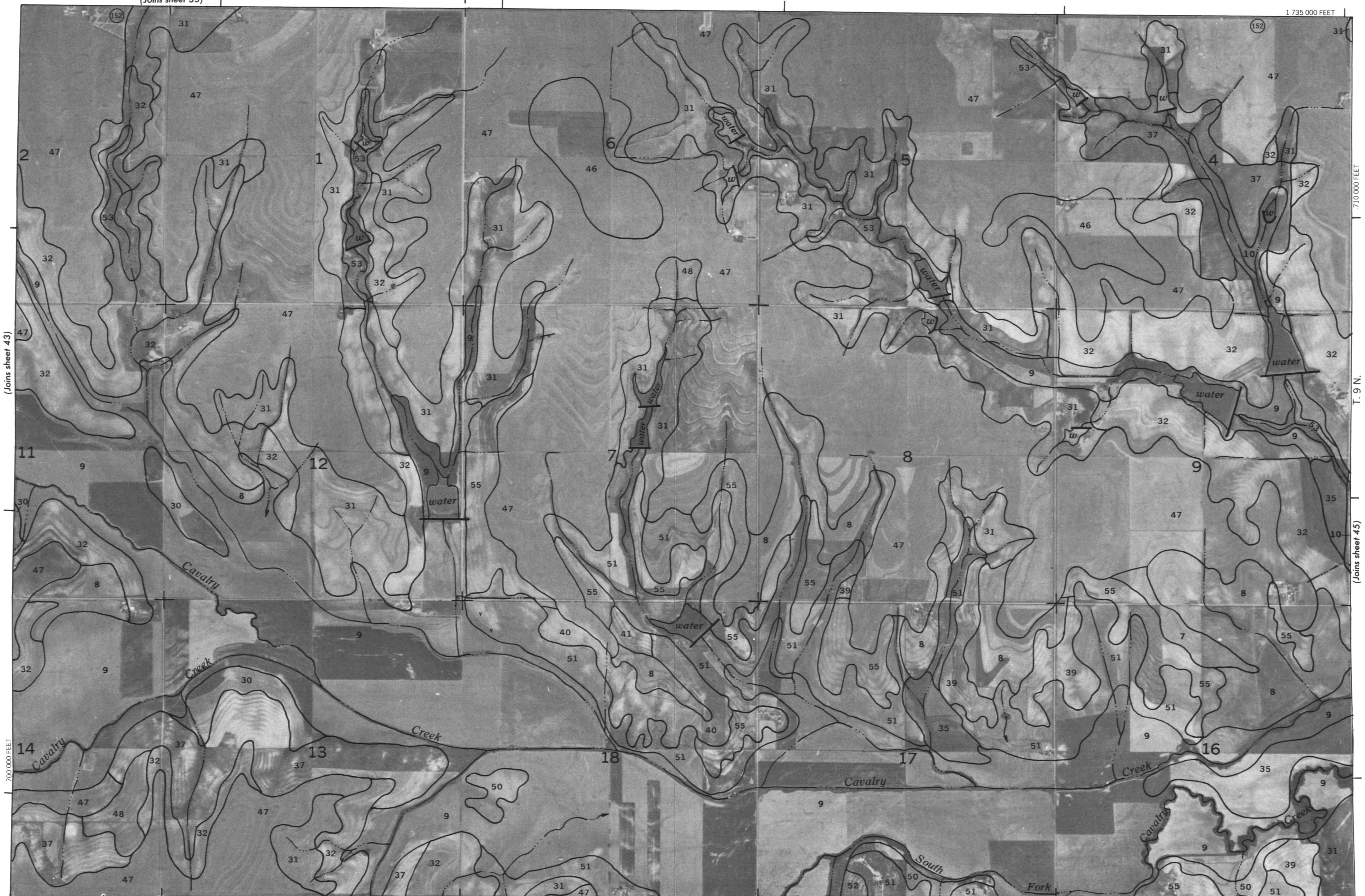
WASHITA COUNTY, OKLAHOMA NO. 43

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 44

N

1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1



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WASHITA COUNTY, OKLAHOMA NO. 44

WASHITA COUNTY, OKLAHOMA NO. 45

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WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 46

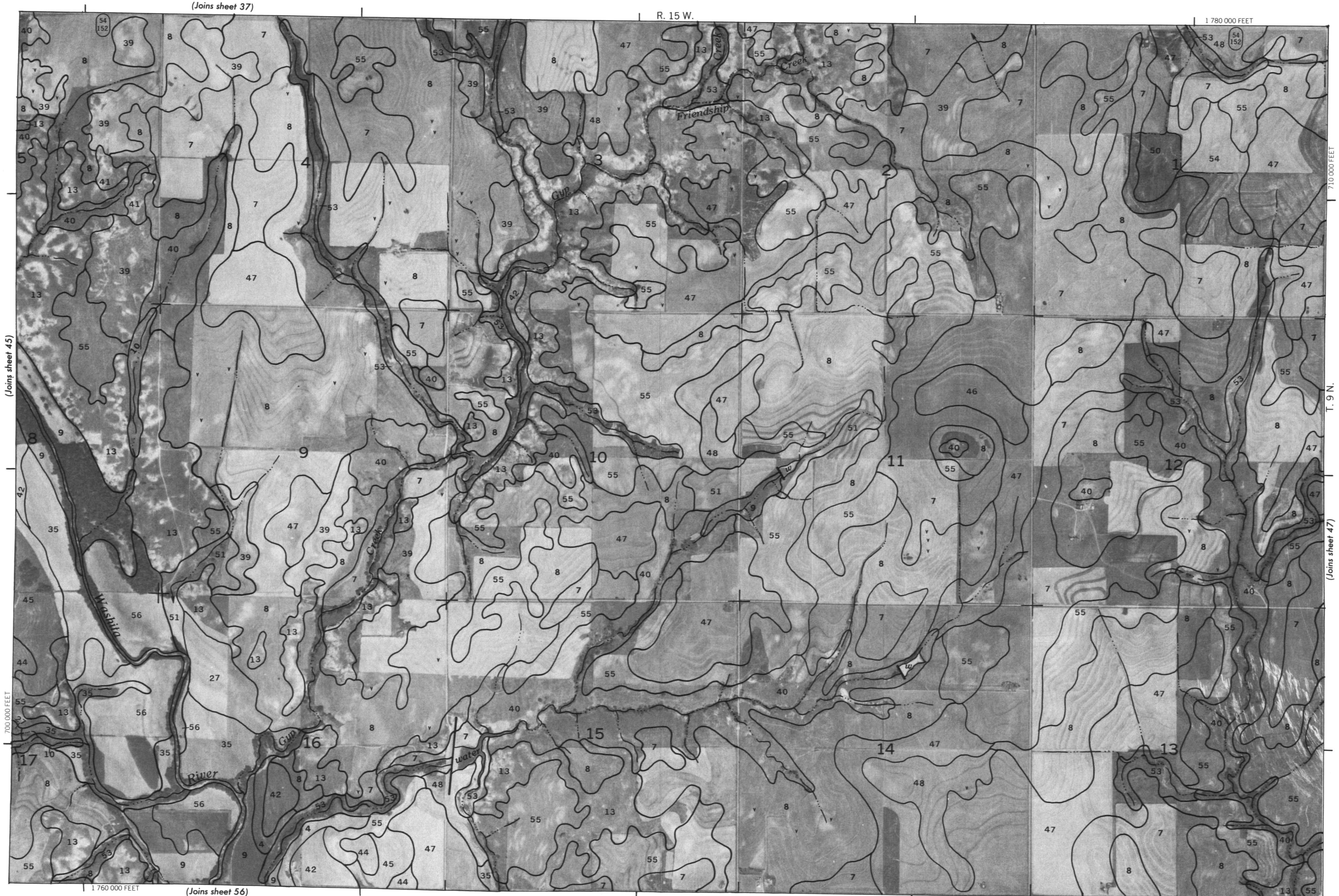
N

1 Mile
5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



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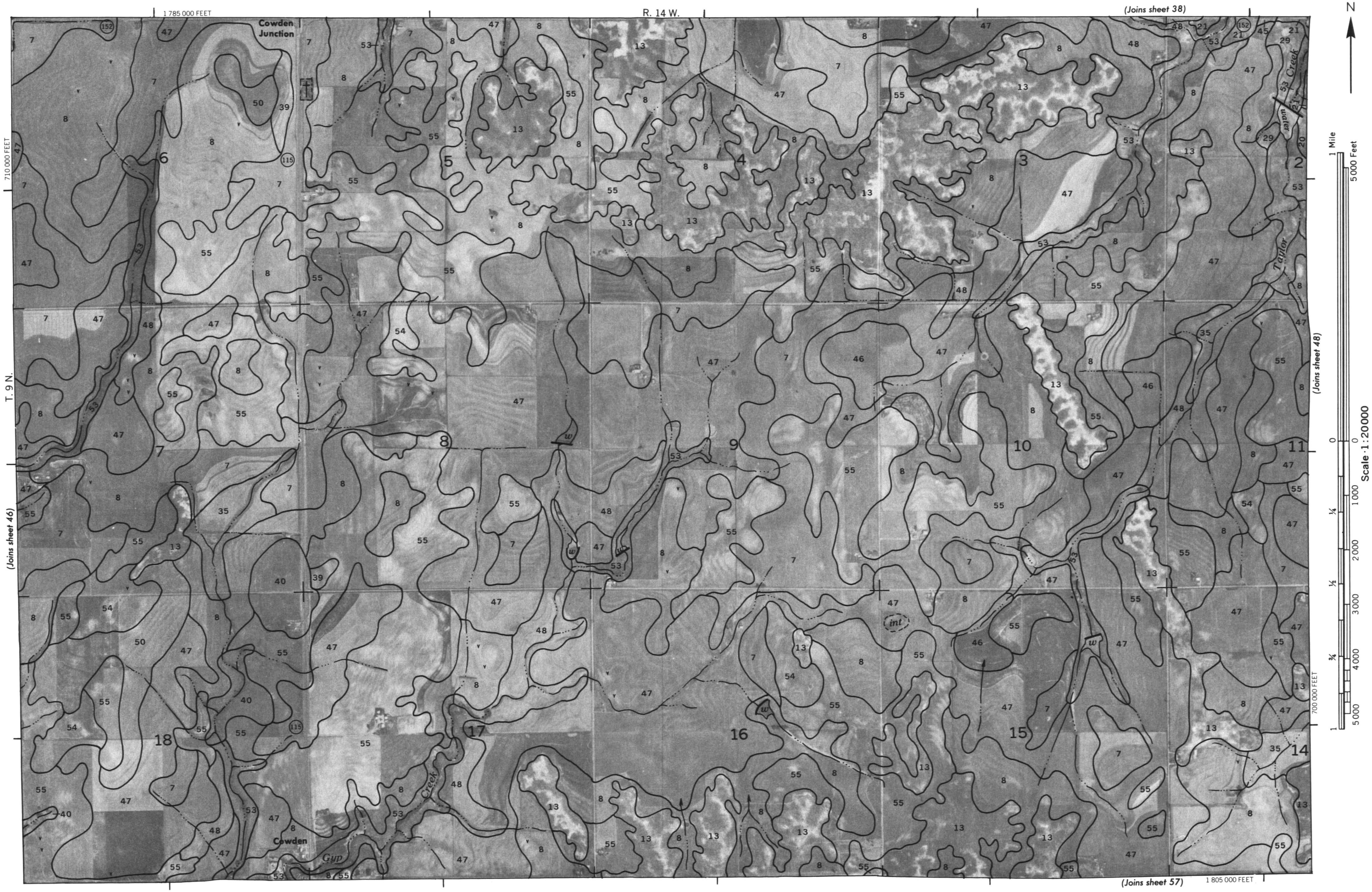
WASHITA COUNTY, OKLAHOMA NO. 46



WASHITA COUNTY, OKLAHOMA NO. 47

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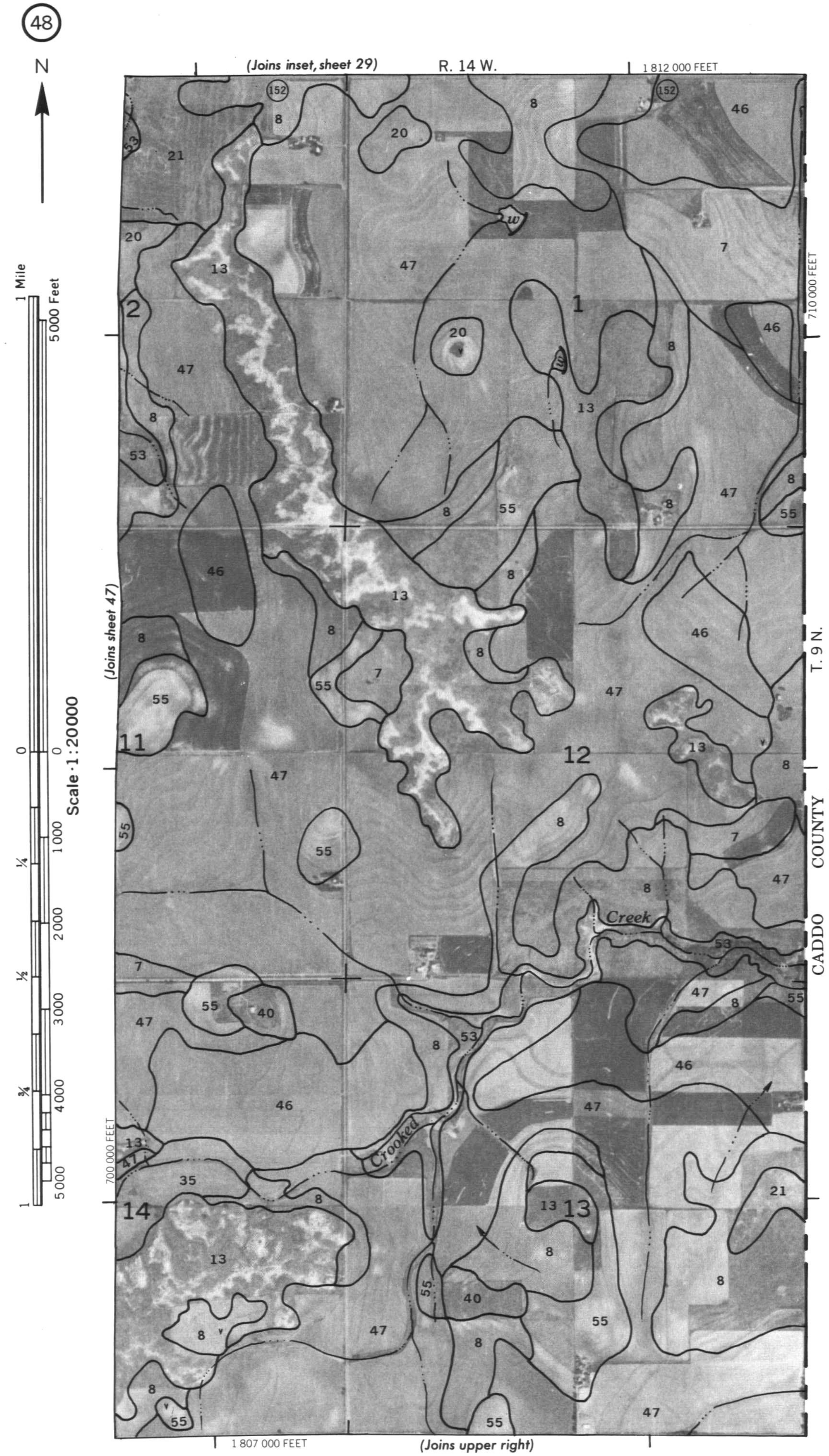
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

48



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(49)

WASHITA COUNTY, OKLAHOMA NO. 49

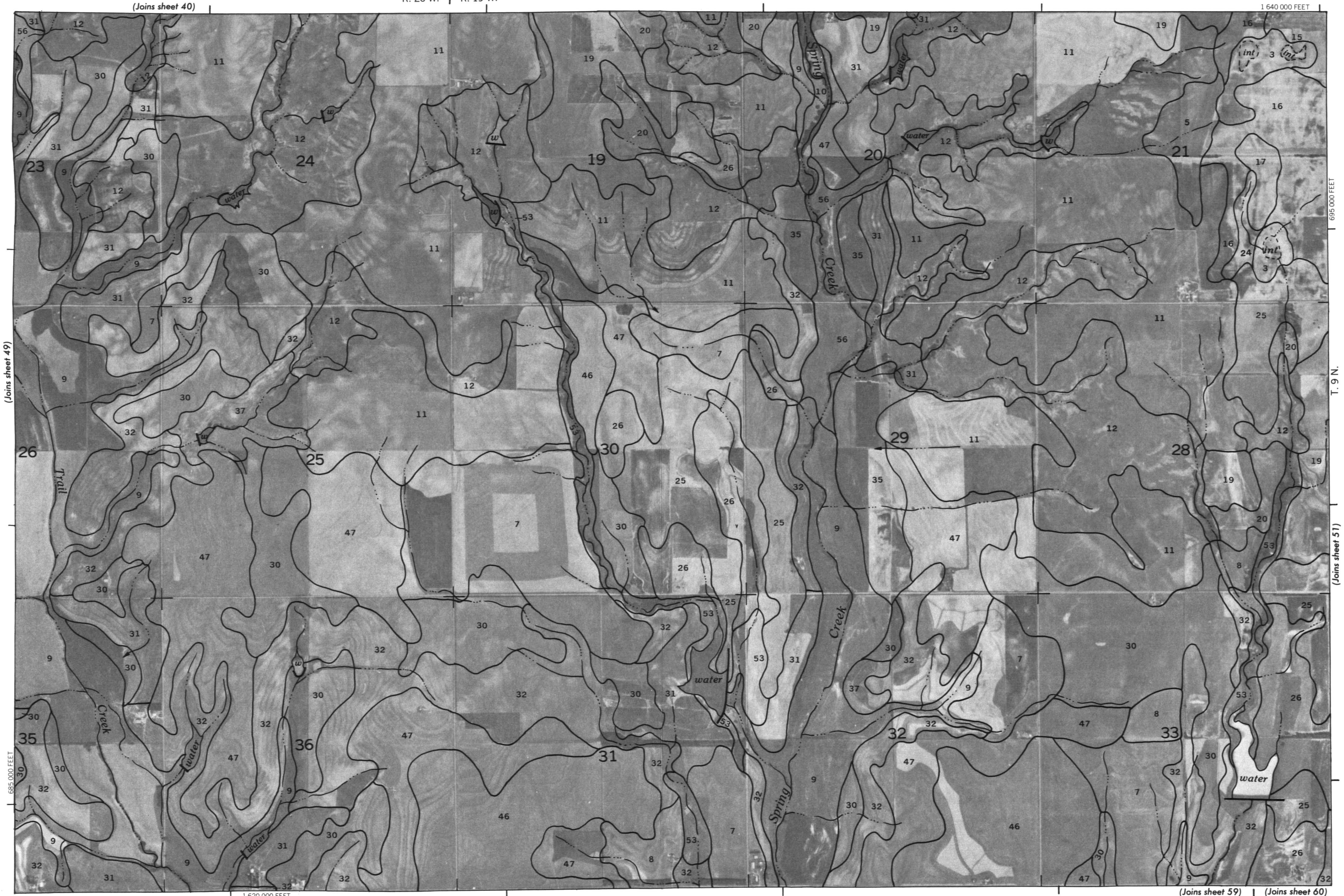
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5

WASHITA COUNTY, OKLAHOMA NO. 5

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

50



N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

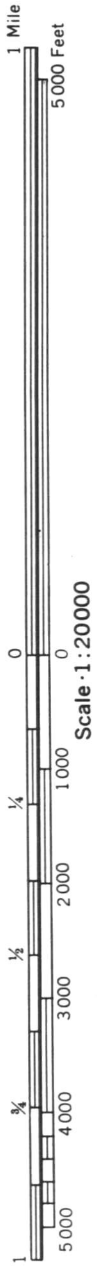
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

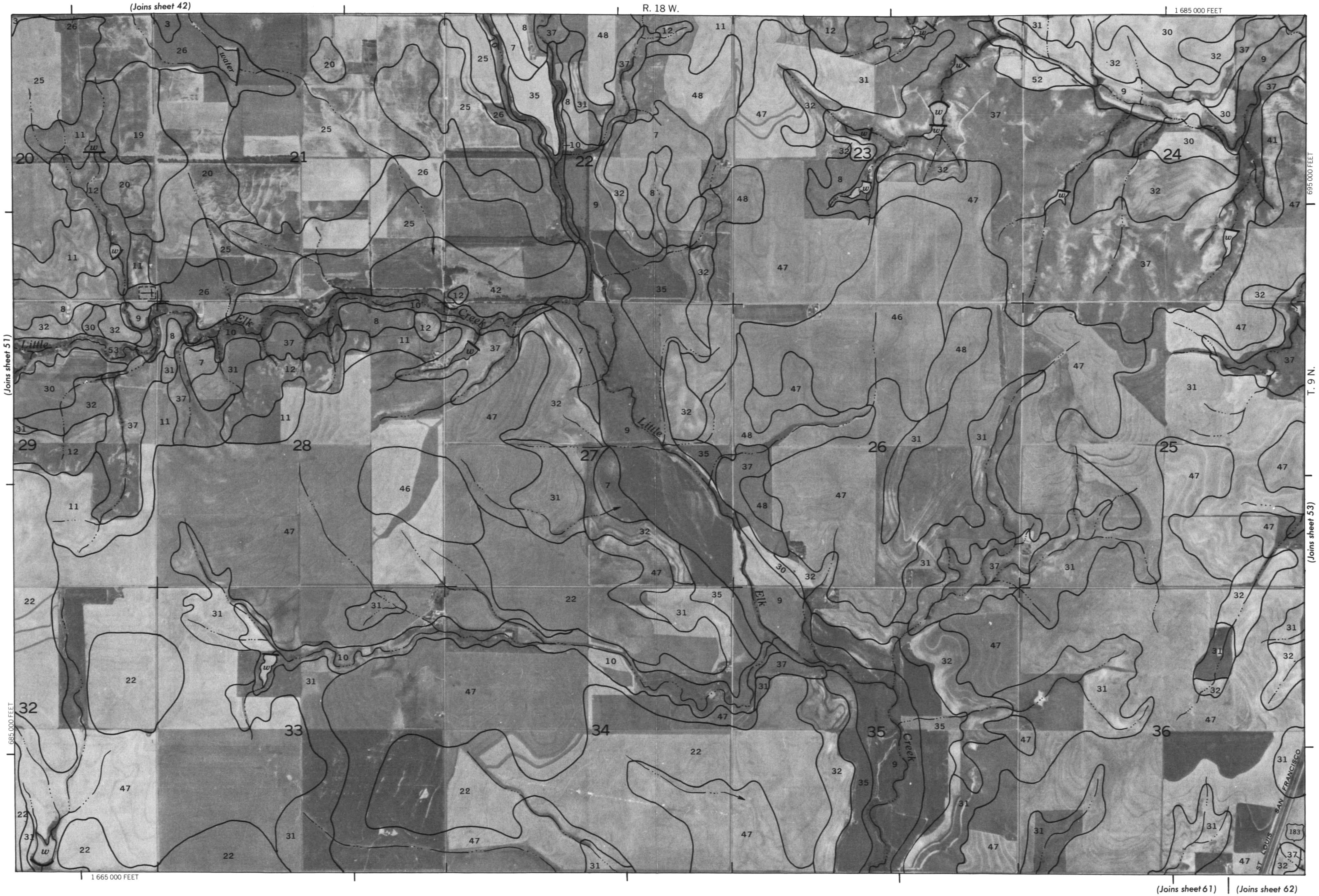
WASHITA COUNTY, OKLAHOMA NO. 51

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

52

N





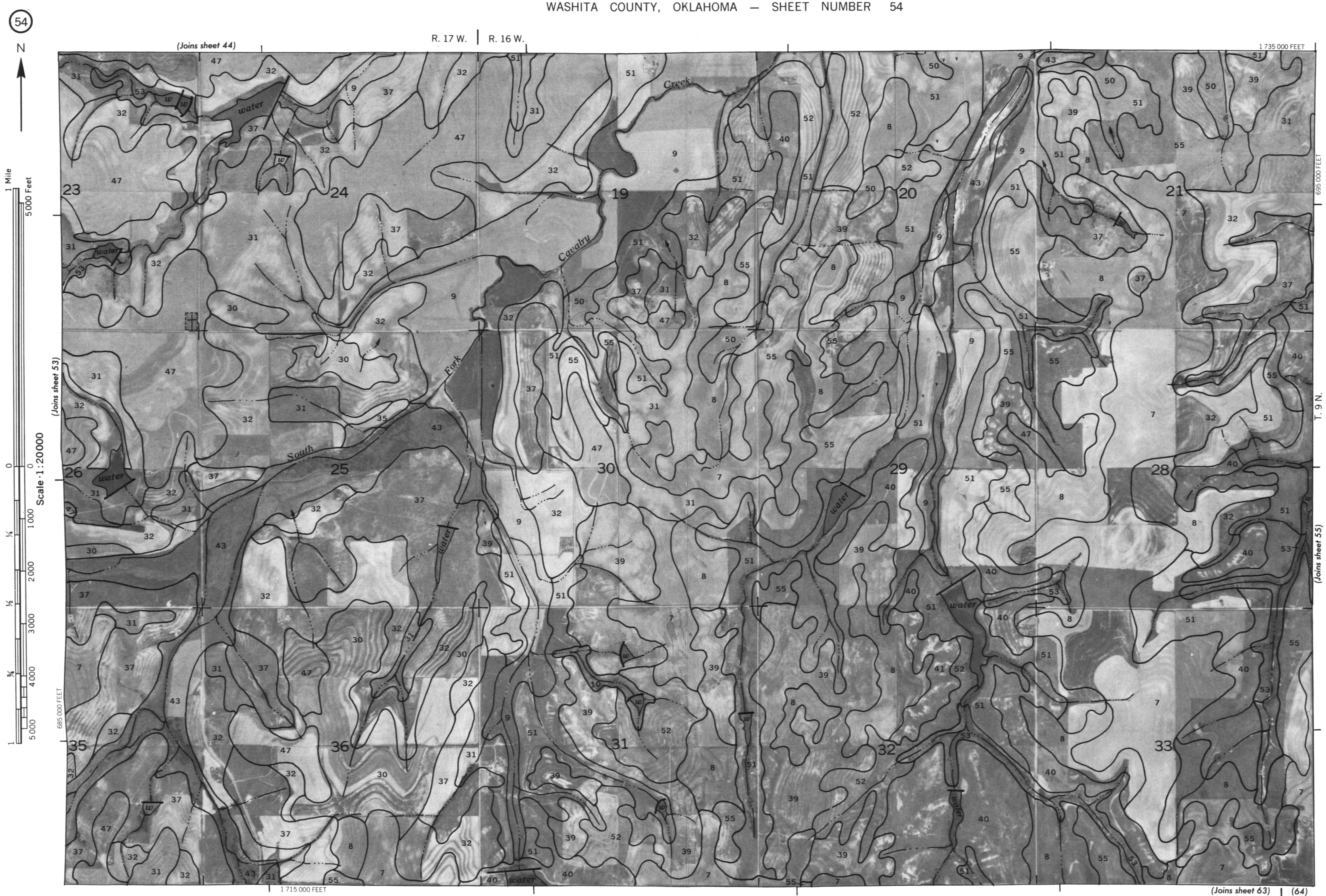
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 52

WASHITA COUNTY, OKLAHOMA NO. 53

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 54



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 54

WASHITA COUNTY, OKLAHOMA NO. 55

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 56

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 56

WASHITA COUNTY, OKLAHOMA NO. 57

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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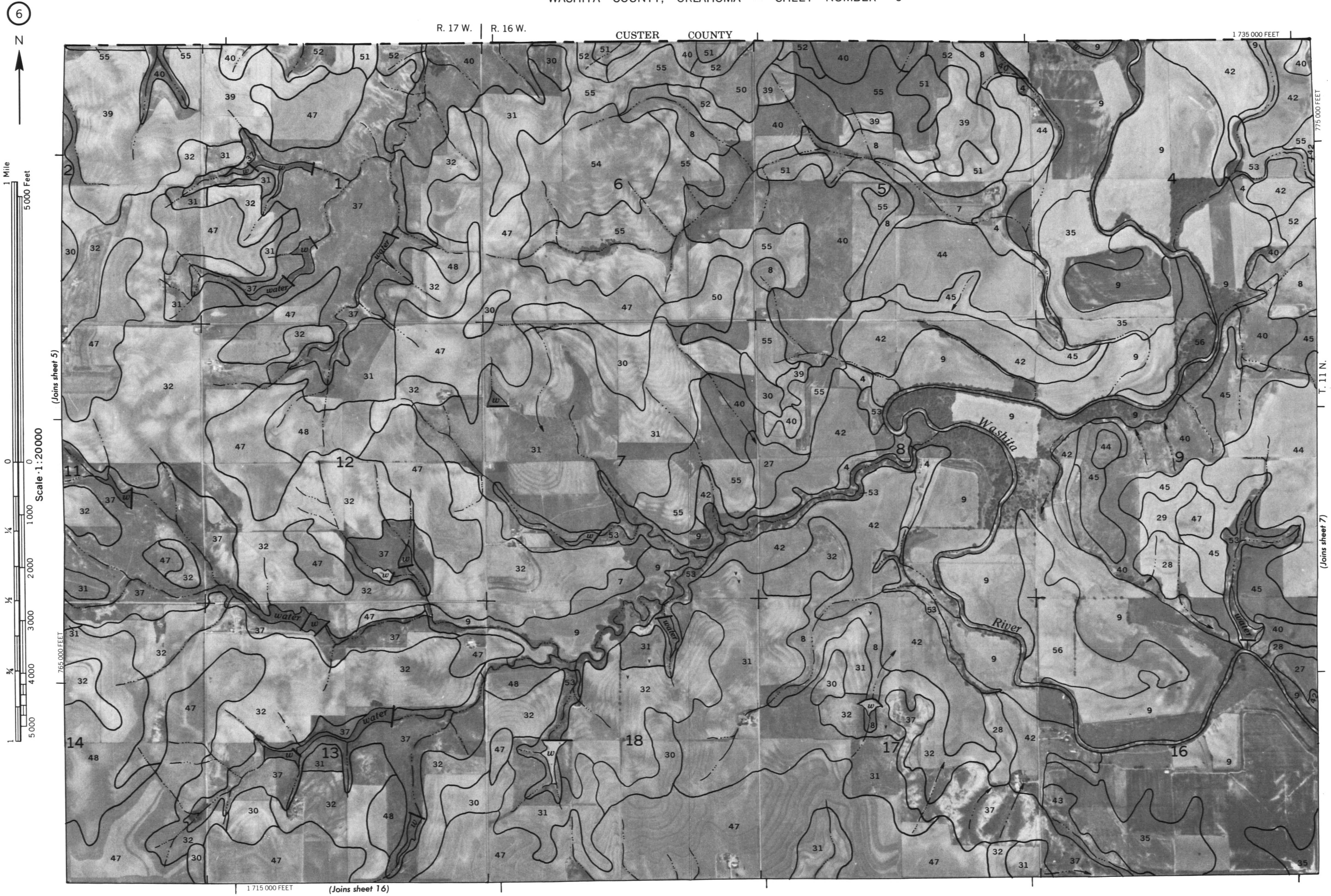
WASHITA COUNTY, OKLAHOMA NO. 59

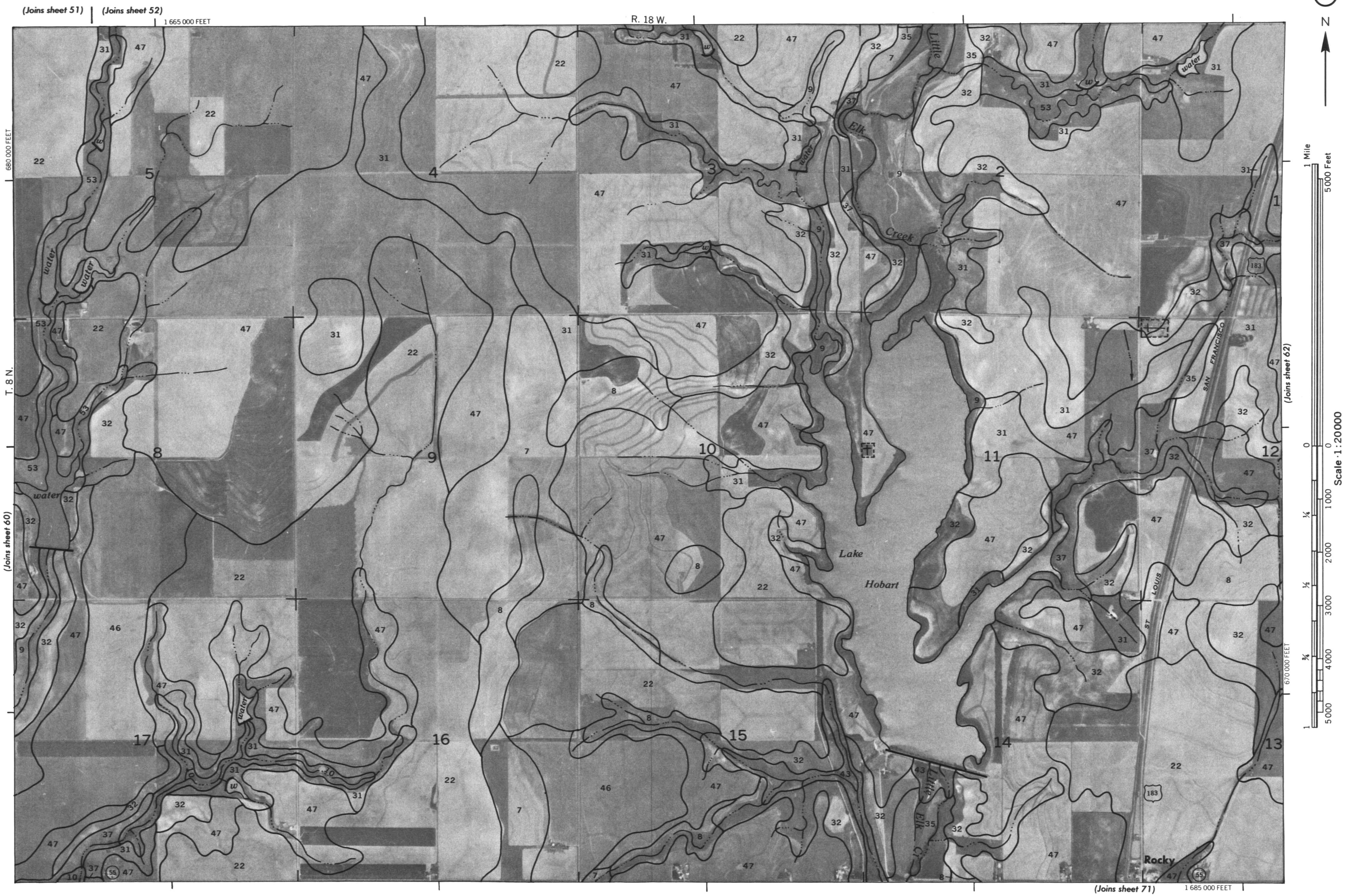
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

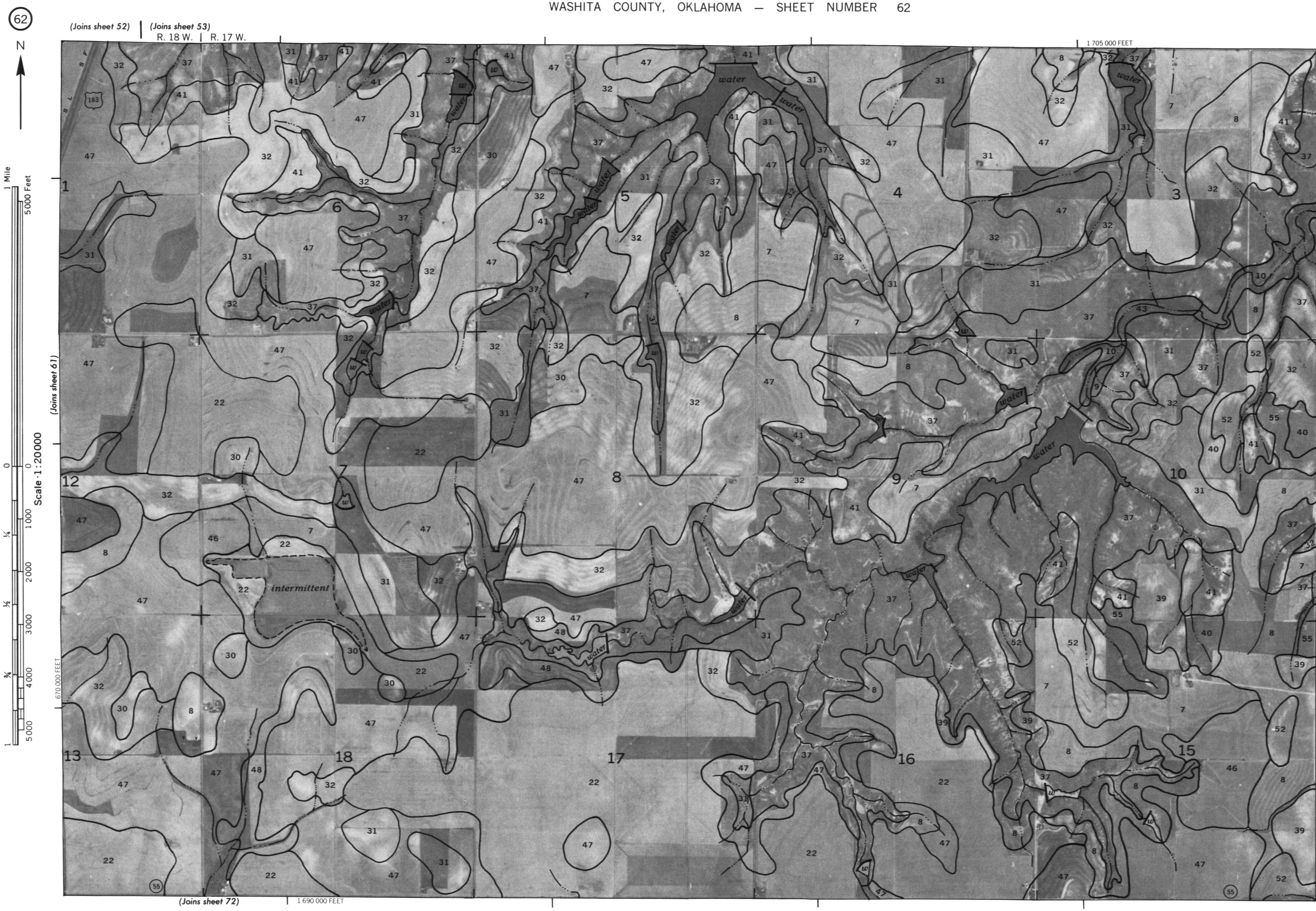
WASHITA COUNTY, OKLAHOMA NO. 6

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



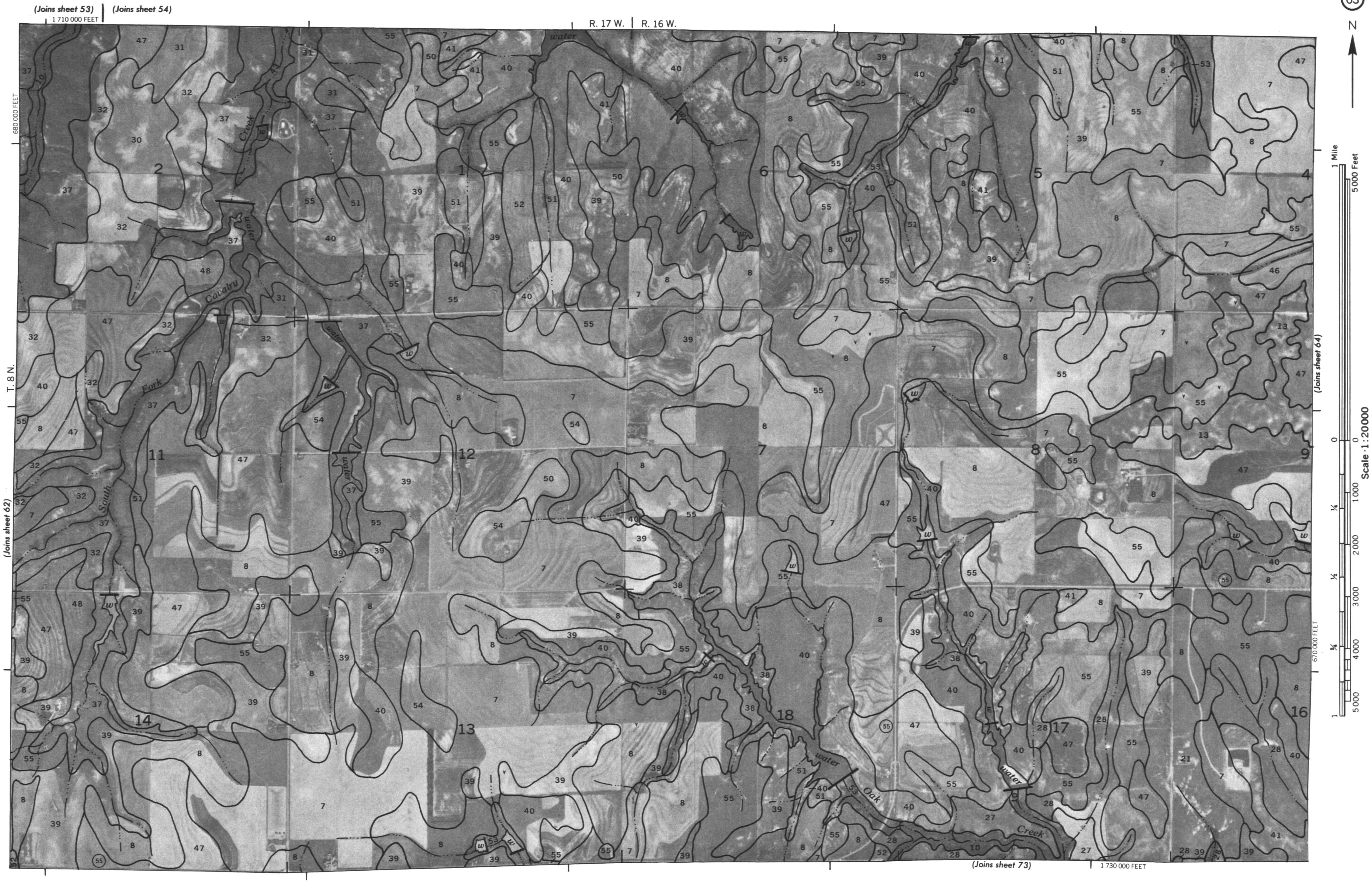
WASHITA COUNTY, OKLAHOMA NO. 61

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 62



WASHITA COUNTY, OKLAHOMA NO. 63

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 64

WASHITA COUNTY, OKLAHOMA NO. 65

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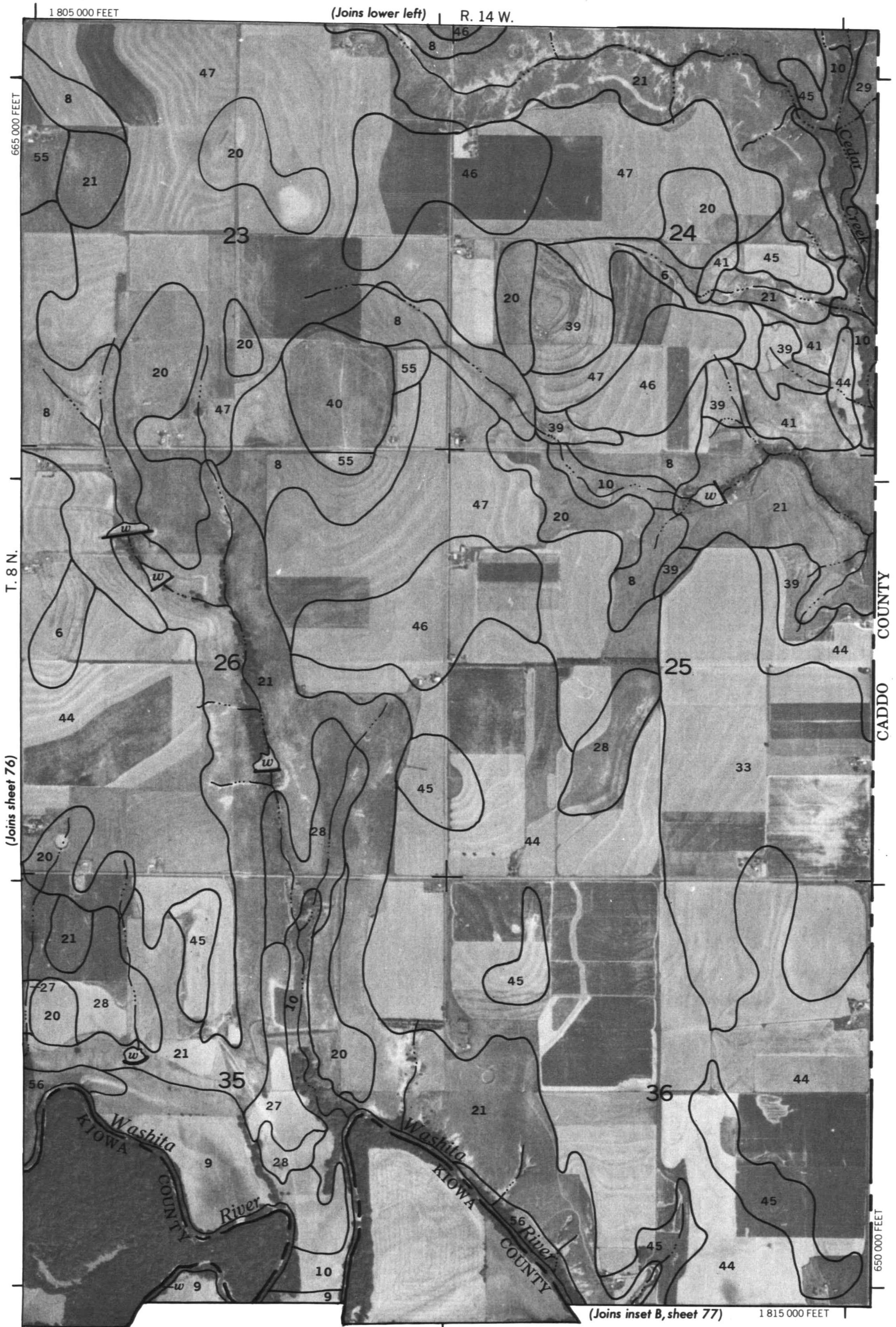
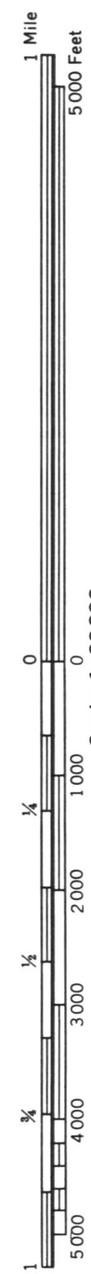
WASHITA COUNTY, OKLAHOMA NO. 66





WASHITA COUNTY, OKLAHOMA NO. 67

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 68

N

1 Mile
5000 Feet
Scale 1:20000

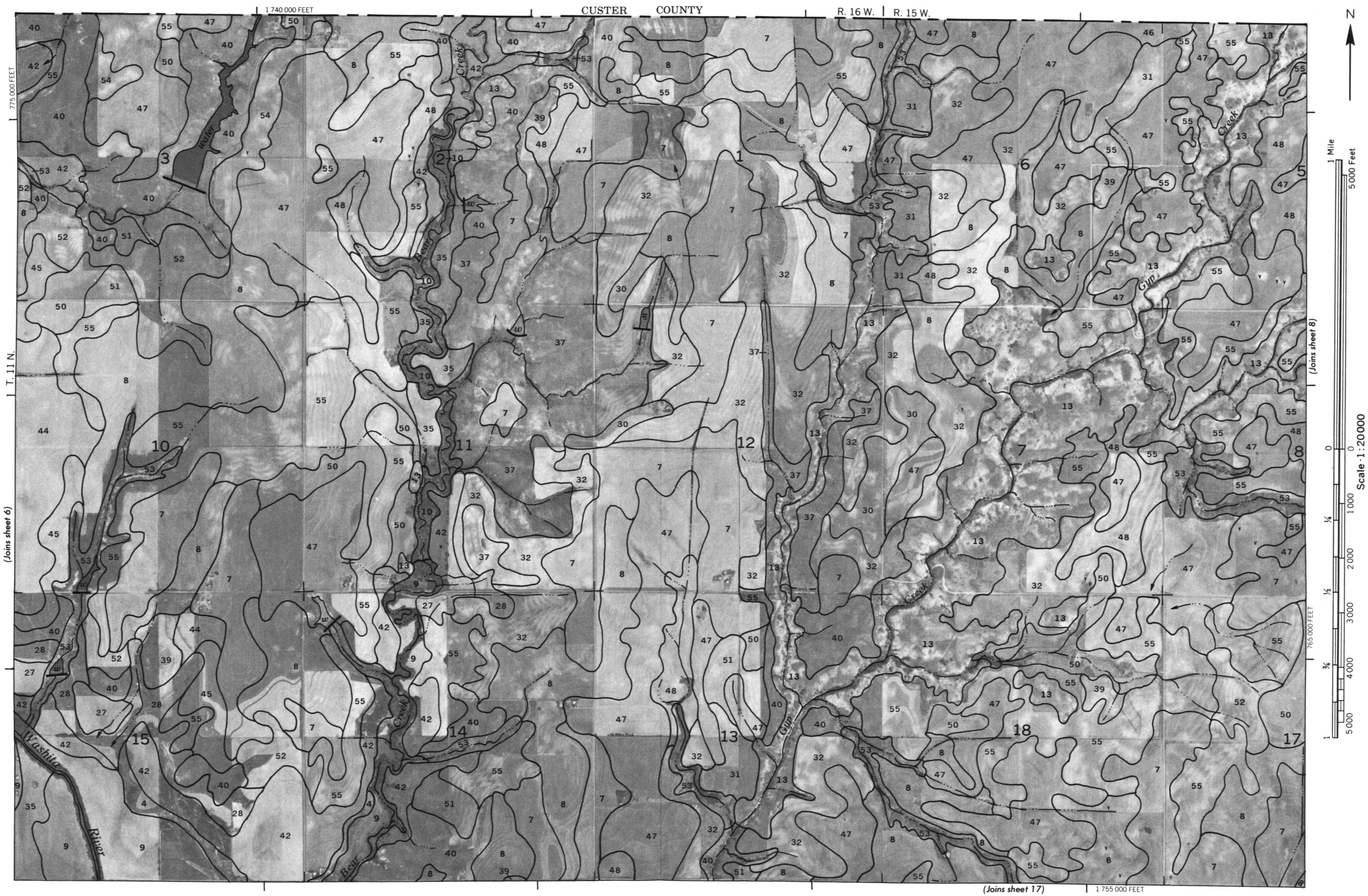
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 68

WASHITA COUNTY, OKLAHOMA NO. 69

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

7



WASHITA COUNTY, OKLAHOMA NO. 7

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 70

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 70

WASHITA COUNTY, OKLAHOMA NO. 71

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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R. 17 W.
R. 16 W.
(Joins sheet 63)
73
N
1 710 000 FEET
665 000 FEET
T. 8 N.
(Joins sheet 72)
(Joins sheet 74)
655 000 FEET
1 730 000 FEET
OLD INDIAN TREATY BOUNDARY
KIOWA COUNTY
Oak Creek
water
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
0

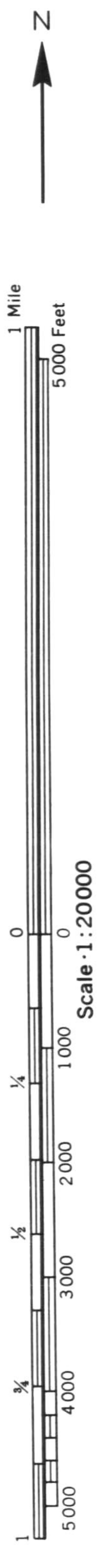
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 74

WASHITA COUNTY, OKLAHOMA NO. 75

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA — SHEET NUMBER 76



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

WASHITA COUNTY, OKLAHOMA NO. 76

WASHITA COUNTY, OKLAHOMA NO. 77

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

National, state or province

County or parish

Minor civil division

Reservation (national forest or park, state forest or park, and large airport)

Land grant

Limit of soil survey (label)

Field sheet matchline & neatline

AD HOC BOUNDARY (label)

Small airport, airfield, park, oilfield, cemetery, or flood pool

Davis Airstrip

FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

Divided (median shown if scale permits)

Other roads

Trail

ROAD EMBLEMS & DESIGNATIONS

Interstate 79

Federal 410

State 52

County, farm or ranch 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

Without road

With road

With railroad

DAMS

Large (to scale)

Medium or small — water, w

PITS

Gravel pit

Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)

Church

School

Indian mound (label) — Indian Mound

Located object (label) — Tower

Tank (label) — GAS

Wells, oil or gas

Windmill

Kitchen midden

WATER FEATURES

DRAINAGE

Perennial, double line

Perennial, single line

Intermittent

Drainage end

Canals or ditches

Double-line (label) — CANAL

Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

Perennial — water, w

Intermittent — int, i

MISCELLANEOUS WATER FEATURES

Marsh or swamp

Spring

Well, artesian

Well, irrigation

Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

CeA FoB2

ESCARPMENTS

Bedrock (points down slope)

Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

Blowout

Clay spot

Gravelly spot

Gumbo, slick or scabby spot (sodic)

Dumps and other similar non soil areas

Prominent hill or peak

Rock outcrop (includes sandstone and shale)

Saline spot

Sandy spot

Severely eroded spot

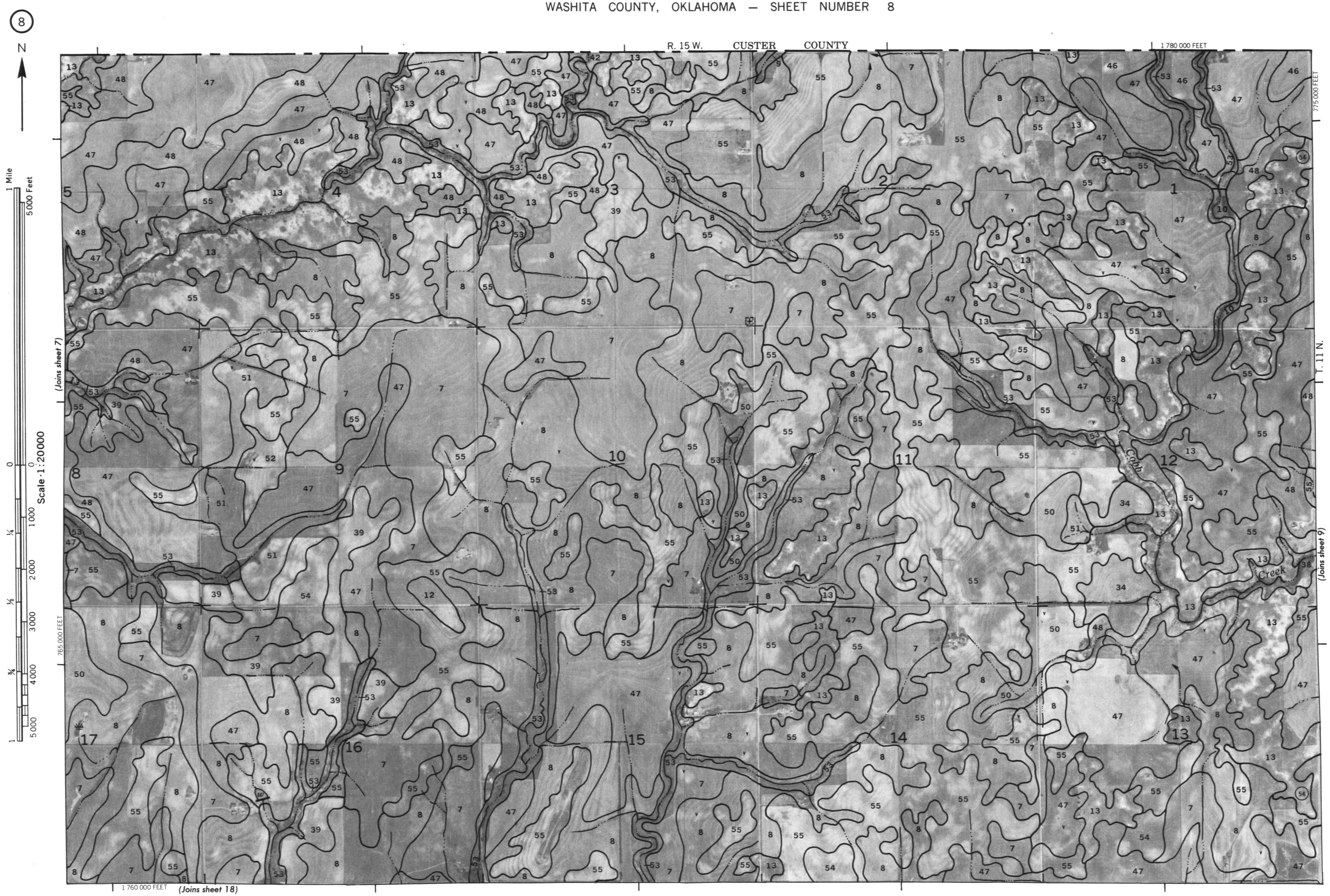
Slide or slip (tips point upslope)

Stony spot, very stony spot

SOIL LEGEND

Map symbols will be published as Arabic numerals. The symbol (W) following the approved name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be reliably estimated.

SYMBOL	NAME
1	Abilene silt loam, 0 to 1 percent slopes
2	Altus and Grandfield soils, 0 to 1 percent slopes
3	Altus and Grandfield soils, 1 to 3 percent slopes
4	Amber very fine sandy loam, 3 to 8 percent slopes
5	Binger fine sandy loam, 1 to 3 percent slopes
6	Binger fine sandy loam, 3 to 5 percent slopes
7	Carey silt loam, 1 to 3 percent slopes
8	Carey silt loam, 3 to 5 percent slopes
9	Clairemont silt loam, occasionally flooded
10	Clairemont silt loam, frequently flooded
11	Cordell silty clay loam, 1 to 5 percent slopes
12	Cordell-Rock outcrop complex, 2 to 15 percent slopes
13	Cornick-Rock outcrop complex, 1 to 12 percent slopes
14	Devol loamy fine sand, 0 to 3 percent slopes (W)
15	Devol loamy fine sand, 3 to 8 percent slopes (W)
16	Devol-Grandfield complex, 0 to 3 percent slopes (W)
17	Devol-Grandfield complex, 3 to 8 percent slopes (W)
18	Dill fine sandy loam, 1 to 3 percent slopes
19	Dill-Quinlan complex, 1 to 3 percent slopes
20	Dill-Quinlan complex, 3 to 5 percent slopes
21	Dill-Quinlan complex, 5 to 12 percent slopes
22	Dodson silt loam, 0 to 1 percent slopes
23	Dougherty-Eufaula complex, 3 to 8 percent slopes (W)
24	Grandfield fine sandy loam, 0 to 1 percent slopes
25	Grandfield fine sandy loam, 1 to 3 percent slopes
26	Grandfield fine sandy loam, 3 to 5 percent slopes
27	Hardeman fine sandy loam, 1 to 3 percent slopes
28	Hardeman fine sandy loam, 3 to 5 percent slopes
29	Hardeman fine sandy loam, 5 to 8 percent slopes
30	Obaro silty clay loam, 1 to 3 percent slopes
31	Obaro silty clay loam, 3 to 5 percent slopes
32	Obaro silty clay loam, 2 to 5 percent slopes, eroded
33	Pond Creek fine sandy loam, 0 to 1 percent slopes
34	Pond Creek fine sandy loam, 1 to 3 percent slopes
35	Port silt loam
36	Pratt loamy fine sand, 5 to 12 percent slopes (W)
37	Quinlan-Obaro complex, 5 to 12 percent slopes
38	Quinlan-Rock outcrop complex, 8 to 20 percent slopes
39	Quinlan-Woodward complex, 2 to 5 percent slopes, eroded
40	Quinlan-Woodward complex, 5 to 12 percent slopes
41	Quinlan and Dill soils, 2 to 12 percent slopes, severely eroded
42	Reinach silt loam
43	Retrop silty clay loam
44	Shellabarger fine sandy loam, 1 to 3 percent slopes
45	Shellabarger fine sandy loam, 3 to 5 percent slopes
46	St. Paul silt loam, 0 to 1 percent slopes
47	St. Paul silt loam, 1 to 3 percent slopes
48	St. Paul silt loam, 3 to 5 percent slopes
49	Vernon-Rock outcrop complex, 2 to 12 percent slopes
50	Woodward silt loam, 1 to 3 percent slopes
51	Woodward silt loam, 3 to 5 percent slopes
52	Woodward silt loam, 5 to 8 percent slopes
53	Woodward-Clairemont complex
54	Woodward-Quinlan complex, 1 to 3 percent slopes
55	Woodward-Quinlan complex, 3 to 5 percent slopes
56	Yahola fine sandy loam



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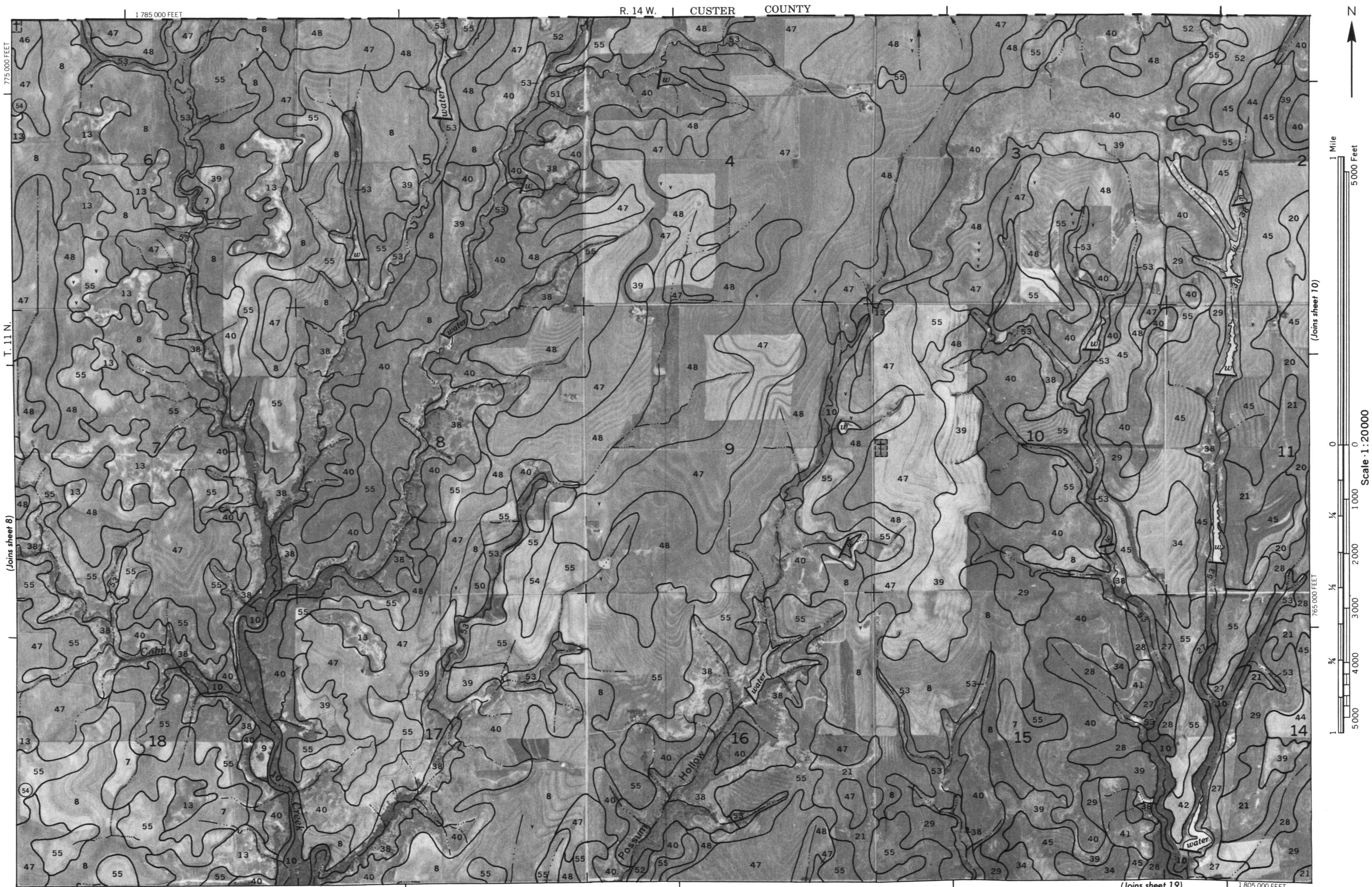
WASHITA COUNTY, OKLAHOMA NO. 8



WASHITA COUNTY, OKLAHOMA NO. 9

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